A PROSPECTIVE STUDY ON "A SAFER TECHNIQUE OF CLOSURE OF PEPTIC ULCER PERFORATION USING FIGURE OF EIGHT STITCH”

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BONAFIDE CERTIFICATE

This is to certify that the dissertation entitled **A PROSPECTIVE STUDY ON "A SAFER TECHNIQUE OF CLOSURE OF PEPTIC ULCER PERFORATION USING FIGURE OF EIGHT STITCH"** is a record work done by **Dr.S.Satheess.,** under my direct supervision and guidance during the period of January 2017 -September 2017.

This has been submitted in partial fulfillment of the award of M.S. Degree in General Surgery (Branch I) to The Tamil Nadu Dr. M.G.R. Medical University, Chennai 600 032.

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is a bonafide research work done by **Dr.S.SATHEESS.**, Post Graduate Student, Department of General Surgery,MADURAI MEDICAL COLLEGE AND GOVERNMENT RAJAJI HOSPITAL, MADURAI, under the guidance and supervision of **Prof.Dr.P.AMUTHA.M.S.,FIAGES,** Professor, Department of General Surgery, MADURAI MEDICAL COLLEGE AND GOVERNMENT RAJAJI HOSPITAL, MADURAI.

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DECLARATION

I, **Dr.S.SATHEESS.,** solemnly declare that the dissertation titled **APROSPECTIVE STUDY ON "A SAFER TECHNIQUE OF CLOSURE OF PEPTIC ULCER PERFORATION USING FIGURE OF EIGHT STITCH"**is a bonafide work done by me inthe Department of General Surgery at Government Rajaji Hospital during the period of january 2017 to September 2017.

I also declare that this bonafide work or a part of this work was not submitted by me or any other for any award, degree and diploma to any university, board either in India or Abroad. The dissertation is submitted to The Tamilnadu Dr.M.G.R. Medical University, towards partial fulfillment of requirement for the award of **M.S**. **DEGREE INGENERAL SURGERY (BRANCH** I).

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INTRODUCTION

PERFORATION IS A COMMON COMPLICATION OF A PEPTIC ULCER DISEASE.PATIENTS WITH PERFORATION USUALLY COMPLAIN OF SUDDEN ONSET FREQUENT EPIGASTRIC PAIN TYPICALLY.FOR MANY PERSONS IT IS THE FIRST SYMPTOM OF THEIR PEPTIC ULCER DISEASE.

FOR SOME OF THEIR PERFORATIONS MAY SEAL SPONTANEOUSLY , HOWEVER OPERATIVE INTERVENTION IS NEEDED IN ALMOST ALL CASES. PERFORATION HAS THE HIGHEST MORTALITY RATE OF ANY COMPLICATION OF ULCER DISEASE APPROACHING ALMOST 15% IN TOTAL. POSTOPERATIVE LEAK IS ONE AMONG THE MOST COMMONLY ENCOUNTERED COMPLICATION FOLLOWING GASTRO DUODENAL PERFORATION CLOSURE VARYING IN INCIDENCE FROM 3 TO 30 %.

POSTOP LEAK AFTER SURGERY IS A PERSISTENT PROBLEM
MUCH TO THE ANNOYANCE OF SURGEON AND PATIENT ALIKE, IN
SPITE OF ADVANCES IN SURGICAL TECHNIQUES AND HEMOSTASIS.

THE OUTCOME OF PATIENTS PRESENTING WITH A PERFORATED ULCER DEPENDS ON:

1.TIME DELAY TO PRESENTATION AND TREATMENT—RECENT DATA SUGGEST INCREASING DELAYS FOR SURGICAL TREATMENT, IN PART AS A CONSEQUENCE OF MORE EXTENSIVE DIAGNOSTIC WORKUP.

2.SITE OF PERFORATION—GASTRIC PERFORATION IS ASSOCIATED WITH A POORER PROGNOSIS.

3.PATIENT'S AGE—ELDERLY PATIENTS WHO OFTEN HAVE ASSOCIATED COMORBIDITIES HAVE A WORSE OUTCOME.

4.PRESENCE OF HYPOTENSION AT PRESENTATION (SYSTOLIC BLOOD PRESSURE<100).

RECENT STUDIES SHOW THAT IN CAREFULLY SELECTED GROUPS OF PATIENTS A PERFORATION CAN BE TREATED CONSERVATIVELY WITH NASOGASTRIC DECOMPRESSION AND ANTIBIOTICS. THIS APPROACH SHOULD, HOWEVER, BE USED ONLY IF A WATER-SOLUBLE CONTRAST STUDY HAS CONFIRMED THAT THE ULCER IS SEALED WITH NO EXTRAVASATION OF CONTRAST INTO THE PERITONEAL CAVITY.

SUCH PATIENTS SHOULD BE FOLLOWED CLOSELY WITH REGULAR PHYSICAL EXAMS AND, IF THEIR ABDOMINAL EXAM OR LABORATORY FINDINGS INDICATE PROGRESSIVE SEPSIS, SHOULD UNDERGO SURGERY. THIS APPROACH IS GENERALLY USED FOR INDIVIDUALS WHO HAVE A PERFORATION OF 24 HOURS' DURATION, ARE STABLE,AND OFTEN HAVE SIGNIFICANT COMORBIDITIES THAT INCREASE THE RISK OF SURGICAL INTERVENTIONS.

IN THIS STUDY THE INTEGRITY OF THE CLOSURE TECHINIQUE USING THE FIGURE OF EIGHT STITCH IS ASSESSD AND COMPARED TO THE CONVENTIONAL GRAHAMS OMENTAL PATCH CLOSURE TECHNIQUE.

THIS IS DUE TO THE FACT THAT IN PATIENTS WITH HIGH GRADE SEPTICEMIA FOLLOWING PERFORATION THE OMENTUM IS OFTEN FOUND TO BE UNHEALTHY AND THE EDGES OF THE ULCER ARE INDURATED,SO A SAFE METHOD OF USING THE FIGURE OF EIGHT STITCH HELPS IN CLOSURE OF THE PERFORATION AND DECREASES THE LEAK RATE, FURTHER MORBIDITY AND MORTALITY.

AIMS AND OBJECTIVES

Aim of the study

- **To assess the efficacy and ease of Figure of eight method of closure of gastroduodenal ulcer perforation**

- **To statistically compare the procedure with the conventional Grahams Omental Live patch closure in terms of per- operative ease and post operative outcome**

REVIEW OF LITERATURE

Perforation of acute or chronic duodenal ulcer has become a relatively uncommon cause of an acute abdominal catastrophe, substantially less common in clinical practice than in publications of two or three decades ago. Accurate epidemiologic studies of this disease entity with substantial numbers of patients are generally limited in value because of the local or regional nature of the study and its incidence. There is a remarkable difference in more recent studies from those of the 1990s, in which as simple a factor as gender now demonstrates a very slight preponderance in men, whereas previous studies suggested that men constituted 80% of patients with perforated duodenal ulcer. Equally remarkable is that more recent studies demonstrate a significant increase in mean age in these patients, being reported as high as 67 years in men and 77 years in women, a statistically significant difference.

There is now more uniform agreement in recent reports concerning the incidence of Non steroidal anti-inflammatory drugs (NSAIDs) used by patients presenting with perforated ulcers; these vary from a low of 32% to 60% in those patients with perforated ulcer in whom NSAID usage was implicated as a major factor .

DIAGNOSIS

In general, the diagnosis of perforated peptic ulcer is not difficult to make, and a well-informed senior medical student will ordinarily arrive at the appropriate diagnosis, given sufficient information. The important historical features are well known, including sudden onset of severe upper abdominal pain, which rapidly becomes generalized over a period of one to several hours or less, coupled with a previous history of chronic epigastric distress, “dyspepsia,” use of NSAIDs or acetylsalicylic acid, and perhaps previous testing for Helicobacter pylori,with either positive or negative findings. The physical examination ordinarily demonstrates diffuse abdominal pain, tenderness, guarding, and, if more than 1 or 2 hours have elapsed since the onset of symptoms,“board-like”rigidity of the abdominal wall. Bowel sounds may be present or absent, although as the time interval lengthens between the onset of severe pain and the examination, the bowel sounds tend to become hypoactive or absent.

The“gold standard”for diagnosis remains the finding of pneumo peritoneum, which can be seen on an upright postero anterior radiograph of the chest or the left lateral decubitus view of the abdomen. If the radiograph is taken with the patient sitting and the patient has been in the upright position for 5 to 10 minutes, as little as 5 mL of free air can be seen under one or the other hemi diaphragm, most easily identified on the right side. With the left lateral decubitus position, the patient should be lying on the left side, and the first film should be taken with the patient on the cart in that position so that even a very small amount of air will become visible with, again, 5 to 10 minutes in the indicated position. If free air is seen, there is probably not a great deal of advantage to further diagnostic studies, although ultrasound will also demonstrate

the free air and occasionally a “fish-eye sign” when the anterior wall of the duodenum is perforated. Computed tomography (CT) is not often necessary, although it can be used when free air is not detected on conventional films or ultrasound; it is highly accurate in detecting even very small amounts of extra luminal free air. CT may show inflammatory changes in the para duodenal tissue and the tissues of the right sub hepatic space in approximately one half of patients. Fluid collections may be seen in the right sub hepatic space or in the lesser sac in three quarters of patients who prove to have perforated duodenal ulcer. Perhaps more important, ruptured sigmoid diverticulitis as a cause of free air in the abdomen can generally be effectively ruled out by the absence of inflammatory changes in the lower abdomen and the sigmoid colon itself, allowing one to use the optimal incision if an open procedure is to be done or to place laparoscopic trocars appropriately if that operative approach is employed.

In a few patients with perforated ulcer, especially those with micro perforations, free peritoneal air was not present and could not be demonstrated by any radiologic studies. With ultrasound, free intraperitoneal fluid may be the most important indication of perforation, and it was shown in a study by Grassi et al. that in approximately 8% of patients with perforated juxtapyloric or duodenal ulcers free air could not be detected. This group contended that CT examination is of little diagnostic value until at least 6 hours from the onset of symptomatology in the absence of pneumo peritoneum on plain abdominal film or ultrasound study.

The appearance of patients with a precipitous onset of sudden severe abdominal pain, accompanied by pneumo peritoneum, leads to the presumptive diagnosis of perforated peptic ulcer, primarily duodenal, until proved otherwise. In current surgical practice, it is important to know whether such a patient is H. pylori positive, although the opportunity to make that

decision or to arrive at an absolute conclusion preoperatively may be limited in some places .

H PYLORI INFECTION IN PERFORATED PEPTIC ULCER

H. pylori has been extensively studied for the past two decades since it was first found to be associated with chronic peptic ulcer disease. It has become apparent that more than 50% of adults in North America with or without ulcer disease have H. pylori in their stomach, and approximately 5% of children have a similar infection.

Surgeons must be aware of the need for detecting and treating H. pylori should it be present in any patient with ulcer disease but especially those with perforated peptic ulcer. Ideally, when operating on a patient with perforated duodenal ulcer, the use of a rapid qualitative antibody test in the emergency room would be most desirable. The reagents are provided in a kit and require serum or finger stick blood, and the results can be available in minutes. If the antibody test is positive, the likelihood of H. pylori infection is high; if the test is negative, the patient needs to be tested in the postoperative period with a more definitive antibody test or one of the several tests that measure urease produced by H. pylori. These tests include a13C or 14C urea breath test, which measures the activity of urease produced by the bacteria in the stomach.

The 13C breath test is not appropriate for patients with perforated ulcer as it requires taking the agent by mouth and collecting a breath sample in 30 minutes.14C is a tablet, not acted on by oral bacteria, and the test can be done within 10 minutes.13C is a liquid, is not a radioactive isotope, and can be acted on by oral bacteria, and therefore the test is done in 30 minutes. The urea breath tests cannot be relied upon in patients who are taking proton pump inhibitors, bismuth salts, or antibiotics. Conversely, the antibody tests are not affected by these drugs.

In general, endoscopy is not required for H. Pylori testing, as the indirect tests are adequate for most purposes. On the other hand, if postoperative endoscopy is required to view ulcer healing, three gastric mucosal biopsies should be done and the tissue studied for the presence of H. pylori, a very distinctive organism readily recognized on microscopic study of the biopsy specimens. The non endoscopic tests are based on detection of anti–H. pylori antibodies by enzyme-linked immunosorbent assay (ELISA), Southern blot, or the rapid qualitative antibody test, which can be used in the emergency room or before the patient goes to the operating room. For general screening of patients complaining of epigastric distress or dyspepsia, one of the several tests for H. pylori antibody has proven satisfactory and does not require instrumentation of the patient.

Postoperative treatment of patients who prove to be H. pylori positive has centered around triple or quadruple therapy, the former including a proton pump inhibitor, omeprazole, or lansoprazole, 40 mg; amoxicillin, 1 g; and clarithromycin, 5 mg, all taken twice daily. At least 10 days of therapy is required, but 14 days of continuous therapy would appear to be the best regime and will effect cure of the H. pylori infection in 90%, or perhaps more, of patients. Quadruple therapy includes bismuth subsalicylate as the fourth component, and is used in patients who require retreatment because of a very unusual recurrence of the infection or, more accurately, failure to eliminate the infection with the first course of therapy. It is the responsibility of the surgeon who operates on a patient with perforated peptic ulcer to ensure that appropriate testing and treatment for H. pylori takes place in the postoperative period as soon as the patient is able to tolerate oral medication. Although H. pylori is an extremely important and common factor in the genesis of peptic ulcer, this is not to be translated as

indicating that perforation of the peptic ulcer is caused by H. pylori; rather, the ulcer is caused by H. pylori and failure of an ulcer to heal or recurrence later can only be prevented if H. Pylori is eliminated. A recent study from the United Kingdom by Gilliam et al. in 2001 reported a survey of over 1,000 surgeons that demonstrated that although more than 80% of surgeons prescribed medication to eliminate H. pylori after an operation for bleeding or perforation, fewer than 60% routinely tested patients subsequently for H. pylori eradication. The issue of post treatment testing to be sure that H. pylori is completely eradicated underscores the data that suggest that 5% to 10% of patients appropriately treated with an adequate course will show continued or occasionally recurrent H. pylori infection. The therapeutic principle is that those patients may require a definitive ulcer operation once it is shown that antibiotic and drug therapy is not successful in eliminating the infection.

OPERATIVE VERSUS NON OPERATIVE MANAGEMENT

In a landmark study more than 20 years ago, Boey et al. reported a remarkable series of 213 patients operated on for perforated duodenal ulcer with a very low 4.2% mortality rate. The factors that suggested higher morbidity and mortality rates included serious concurrent medical illness, preoperative hemodynamic instability (including shock), and perforations more than 48 hours in duration at the time the patients presented. Interestingly, several other authors have reported that patients over 70 have a higher mortality rate independent of intercurrent disease, although Boey et al. did not agree. They concluded that closure of perforated ulcer alone is a better choice when any of the above risk factors is identified, and suggested that definitive ulcer surgery in good-risk patients needed further study. A number of such studies were subsequently reported, and, by the mid-1990s, omental patch closure coupled with parietal cell vagotomy had become the operation of choice in patients with chronic ulcer symptoms preceding the perforation, those who had previously been treated for H. pylori, noncompliant patients, patients who were dependent on chronic NSAID treatment, and patients who had experienced ulcer complications in the past. If a patient is known to be H. pylori negative, a definitive ulcer operation probably should be seriously considered in the majority of these patients .

It is very important to acknowledge that not all surgeons have had similar operative experience

with definitive ulcer operations, and in few surgical diseases is this as prominent a factor as in perforated duodenal ulcer. The least traumatic, least complication-prone (because there is no anastomosis) definitive ulcer operation is a parietal cell vagotomy (proximal gastric vagotomy). Many surgical residents enter their fourth or even fifth year without ever having participated in this operation; it is more technically demanding in the sense that the surgeon must be meticulous in maintaining innervation of the distal antrum, at the crow's foot, but also must be sure that the proximal vagal interruption includes, if present, the criminal nerve of Grassi . With regard to laparoscopic procedures, there are few advanced laparoscopic surgeons who have performed this operation with considerable frequency, and so the majority of surgeons have probably not performed enough of these operations to achieve the desired cure rate for duodenal ulcer of more than 90%. As Professor Johnson of Sheffield in the United Kingdom has emphasized, posterior truncal vagotomy with anterior seromyotomy essentially was developed to simplify and therefore shorten the operation, but this variant of the procedure has not been widely adopted. His conclusion is that relatively few surgeons doing emergency peptic ulcer surgery have adequate experience with parietal cell vagotomy, and he therefore recommended suture or omental patch followed by medical treatment including elimination of H. pylori if present, otherwise maintenance on proton pump inhibitors. The judgment each individual surgeon must make is whether he or she feels comfortable in performing an operation that does have technical ramifications that are best dealt with by someone experienced with the operation.

On the other hand, truncal vagotomy and pyloroplasty is relatively straightforward, has a somewhat better cure rate than parietal cell vagotomy, but does require one anastomosis,

probably adding to the complication rate. The incidence of postoperative complications, primarily diarrhea, gastric paresis, and occasional dumping syndrome from the vagotomy, is substantially greater than with parietal cell vagotomy.

Although the nonoperative treatment of perforated peptic ulcer has been used sporadically over the past half-century, it was very slow to be considered in North America until 1998 when Donovan et al. proposed this alternative plan for management of perforated duodenal ulcer. This was a consequence of the development of proton pump inhibitors and recognition of H. pylori as a causative factor in most patients with duodenal ulcer. Donovan et al. postulated that half of perforated duodenal ulcers are sealed at operation, and that seal generally has to be broken down at operation to ensure a firm closure of the perforation. They emphasized, as have Stabile and others, that patients who have been evaluated for H. pylori infection, are negative, and are not septic should undergo a definitive ulcer operation if perforation of their ulcer occurs. Other patients in whom the abdominal findings are largely upper abdominal and who are otherwise stable and exhibit no signs of sepsis should have a gastroduodenogram with water-soluble contrast material. If there is no leak or if the leak is limited to a small area adjacent to the duodenum as outlined by the contrast, the patient can be treated expectantly with nasogastric suction, intravenous fluids, antibiotics, and bedrest. If the perforation allows contrast to disseminate widely in the paraduodenal or subhepatic space, operation to close the perforation with or without a definitive ulcer operation is immediately undertaken. As soon as possible, the patient should be evaluated for H. pylori by the methods outlined above, and, if positive, triple or quadruple antibiotic and drug therapy is the treatment of choice. In patients not operated on for the perforation, elective definitive surgical

management should be considered for the H. pylori –negative patient in whom the perforation occurred while on or following an adequate course of medical management.

There are contraindications to definitive ulcer surgery at the time of closure of a perforation. Serious concurrent medical illness (e.g., myocardial ischemia, previous congestive heart failure, diabetes out of control, chronic obstructive lung disease with chronic respiratoryacidosis, and marginal or inadequate renal function) all represent serious concerns and would discourage one from performing any operation beyond simple patch closure of the ulcer. In addition, patients who are in shock or are hemodynamically unstable on presentation should be subjected to as brief a procedure as possible, and the greatest discrepancy in various reports is whether perforations more than 24 hours old should or should not be considered for definitive operation or whether that figure should actually be 48 hours following the onset of perforation. Kauffman has advocated that perforated duodenal ulcer should be treated only with omental patch closure and postoperative anti secretory medications and antibiotics to eradicate H. pylori, particularly if the patient has been perforated for more than 24 hours or if the patient has not had significant symptoms in the three months pre-perforation. That publication does suggest that patients with perforated duodenal ulcer who are appropriate candidates for parietal cell vagotomy in addition to omental patch closure and antibiotics do well, but questions the actual benefit of proximal gastric vagotomy over the simple omental patch closure and proton pump inhibitor therapy. The other issue that has been raised in the past few years is whether patients with perforated peptic ulcer should be operated on by an open procedure or whether a laparoscopic technique has now superseded that approach. Patching the ulcer with a laparoscope is not a major accomplishment, assuming that a surgeon is trained and able to do

intra corporeal suturing and tying. One significant advantage of the laparoscope is that the surgeon has an excellent view of most of the abdomen and pelvis and can evacuate the collections of fluid, which may be remote from the duodenum in the case of a free perforation. The experienced laparoscopic surgeon can probably accomplish the operation with very little additional time over what would have been required with an open incision. The magnification with the laparoscopic camera can be very helpful; extensive irrigation is possible, although it leads to loss of intra-abdominal pressure as the carbon dioxide gas tends to be aspirated with the fluid, but depending on the experience of the operator, it can be satisfactorily accomplished.

A more significant issue, however, is whether the laparoscopic surgeon's skills allow performance of a definitive ulcer operation of any kind, including parietal cell vagotomy, as expeditiously as can be done through the open approach. Again, this is a matter of individual assessment—hopefully an objective one—by the surgeon of his or her own technical skills with the laparoscope. It would not be advisable to perform one's first parietal cell vagotomy with a laparoscope in a patient with a perforated duodenal ulcer.

There are two ulcer complications likely to make laparoscopic repair difficult, if not prone to failure. The first of these is preexisting gastric outlet obstruction, uncommon to coexist with perforation but certainly possible, and the second is large perforations, greater than 1.5 to 2.0 cm in diameter. Preoperative upper endoscopy could be considered (probably best done in the operating room prior to repair of the perforation), and the performance of a definitive procedure done through an abdominal incision rather than by laparoscopy if either of those findings is encountered would be indicated. One could add that if multiple ulcers were

discovered, specifically one anterior perforated ulcer and a posterior unknown penetrating ulcer, a definitive operation would be required, either through the laparoscope or with an open procedure. A meta-analysis of a number of reports of laparoscopic repair have demonstrated that that approach is superior in the short term because of lesser postoperative pain than with the open operation and, likewise, lesser wound infection. However, also noted was that there was a significantly higher reoperation rate after laparoscopic repair, which Laue emphasizes as an important consideration.

PREOPERATIVE PLANNING

Even patients whose vital signs are stable on admission and who have perforated as recently as several hours before reaching the operating room require substantial fluid replacement prior to the induction of anesthesia. Patients in shock with acute renal insufficiency or cardiopulmonary insufficiency should be resuscitated as rapidly as possible and should be subjected to the simplest procedure possible, patch closure of the duodenal ulcer. Patients aged 70 to 75 years or older with no previous symptoms should have as little done as possible, relying on postoperative proton pump inhibitors that have proven effective in most patients in blocking acid secretion by the parietal cell. Therefore, in elderly patients or those who are hemodynamically unstable, including patients with organ failure, omental patch closure of the ulcer is the most desirable operation, followed by intensive medications both to block acid output and to treat H. pylori, rather than using a more extensive operation to rid the patient of the ulcer diathesis. The trade off in doing a definitive ulcer operation with better chance of permanent cure may be to increase morbidity and mortality when it may not be necessary.

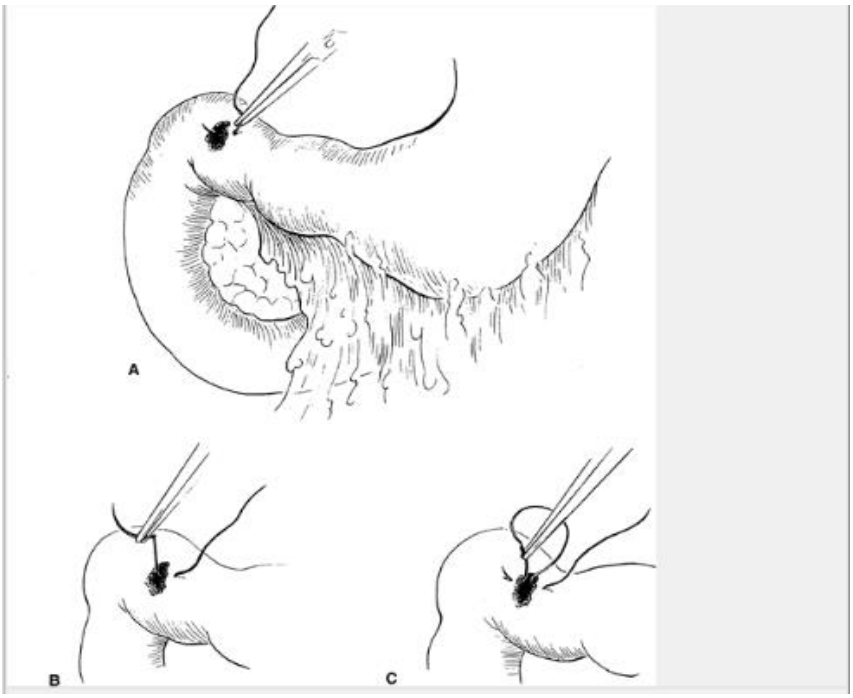
INCISION

If the patient meets the criteria for closure of the duodenal perforation but is not thought to be a candidate for a definitive ulcer operation, a subcostal or transverse incision well above the umbilicus can be used. The exception is the tall, thin patient, with a narrow costal arch, in which case a vertical supraumbilical midline incision would probably be in the surgeon's as well as the patient's best interest. For duodenal ulcer perforation, the two basic goals of the operation are to close the perforation and to irrigate and aspirate as much duodenal content from the peritoneal cavity as possible. Patching the perforation alone would require a short incision, probably transverse, but obtaining sufficient exposure to be able to irrigate and aspirate both above and below the liver, in the left sub phrenic space, and deep in the recesses of the pelvis ordinarily requires a somewhat longer incision, based entirely on the need to retrieve the contaminant and irrigation fluid. If any substantial amount of duodenal content remains loculated in the peritoneal cavity, an abscess in the postoperative period is a not unexpected complication and may prove to be of consequence. In very large patients, or especially obese patients, the vertical incision has the great advantage of being readily extended as far as is necessary to obtain adequate exposure to facilitate irrigation fluid retrieval. If a laparoscopic procedure is to be performed, either for diagnosis or for definitive control of the perforated duodenum, the incision problems are minimal; the opportunity to aspirate most recesses of the abdomen under direct vision is one of the major advantages of this approach. Whether the operation is done through an open abdominal incision or with the laparoscope, the basic procedure is essentially the same, with the omental patch being

mobilized and attached to the anterior duodenal wall with sutures

SURGERY

Perforated duodenal ulcer patch closure has, at least in North America, come to be called the Graham closure, first described by Roscoe Graham in 1938. Modifications have been proposed, and will be discussed, but the open approach to perforated duodenal ulcer has proven to be successful in the vast majority of patients .The perforated ulcer is identified either through the open incision or by laparoscope. In the open approach, laparotomy pads are placed around the perforation to contain any further spill while the sutures are being placed and then the omental tongue is brought into position. Three, sometimes four, sutures are used, preferably of non absorbable material, although poly dioxanone suture (PDS) is quite satisfactory. A small, half-circle needle with the swaged-on suture is placed through the edge of the defect, approximately 0.5 to 1.0 cm from the edge of the perforation.One wall is sewn first, the tip of the needle being brought out through the perforation, grasped with a thumb forceps, and the needle holder reapplied for passage of the needle through the



opposite edge of the perforation (Fig. 2B,C). A relatively small needle should be used to prevent the unfortunate complication of passing the needle through the posterior duodenal mucosa under the open ulcer crater. If the needle is introduced with care being taken to avoid the posterior duodenal mucosa and the needle is passed parallel to the anterior wall of the duodenum, it is extremely unlikely that the posterior duodenal mucosa or wall would be incorporated into the sutures, which, of course, were it to occur, would obstruct the duodenum. Passing a larger needle though both walls of the perforation at once is not as safe and is not recommended. Especially with smaller perforations, the visibility in the lumen of the duodenum is very limited, and much of this is done by taking a shallower, safer bite.

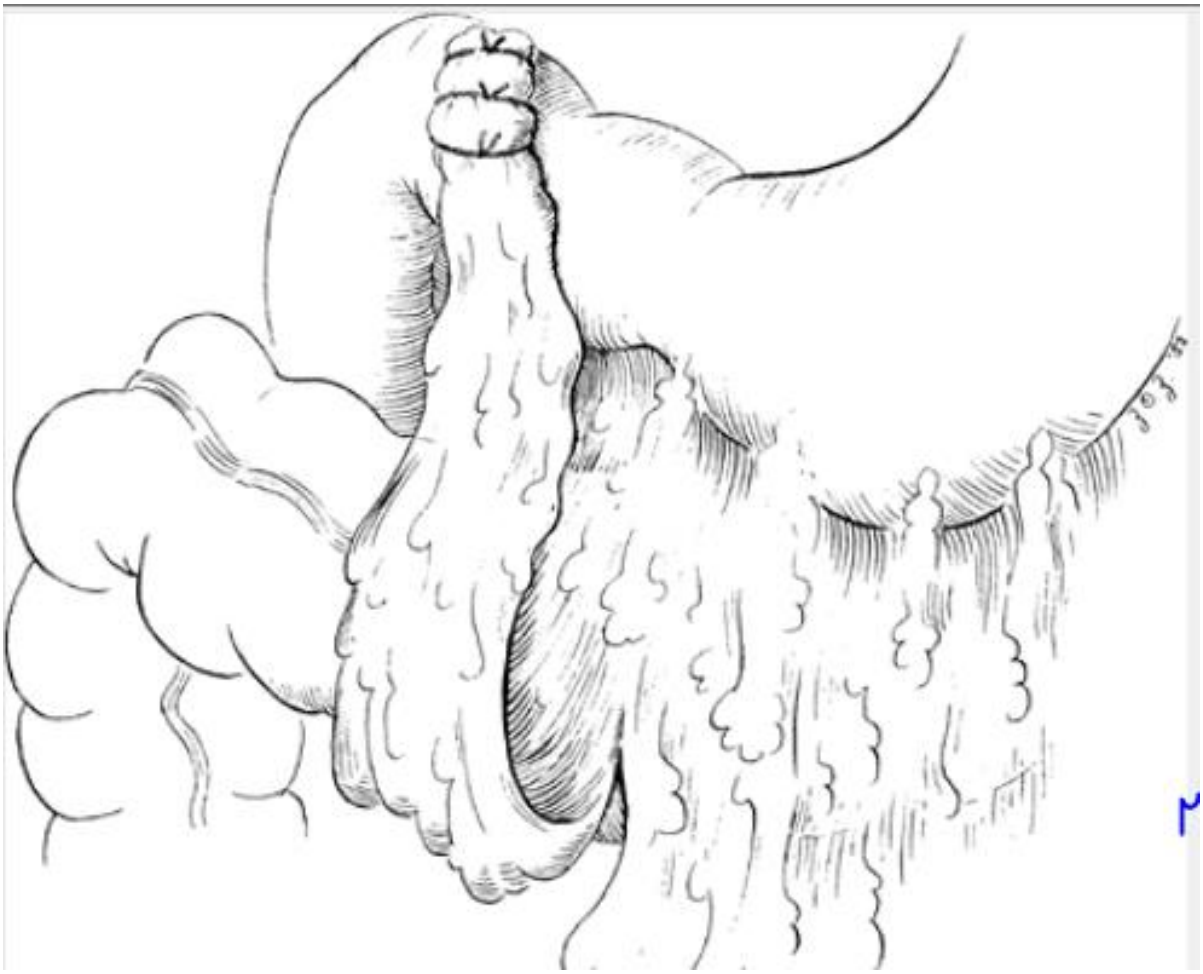
The sutures should all be placed (Fig. 3) before any are tied. Adjacent omentum is brought up to the perforation with the sutures untied and laid out on the anterior surface of the duodenum, and are successively tied from the superior to the inferior side, so as to tampon the perforation with the vascularized omental pedicle graft (Fig. 4). Care should be exercised to be sure that the sutures are tied sufficiently snugly to hold the omentum in place, but the tension exerted by the tied sutures on the omentum should be such that the blood supply to the omentum is not impaired. The patch must be a living omental patch, and the omentum should not be strangulated.

Some surgeons have modified this technique in which the three or four sutures are placed and are then tied to close the ulcer. The omental patch is placed on the tied sutures (as illustrated in Fig. 5A), and another set of knots is tied to hold the omentum in place over the duodenal ulcer perforation closure. As demonstrated in the illustration, there is concern that the

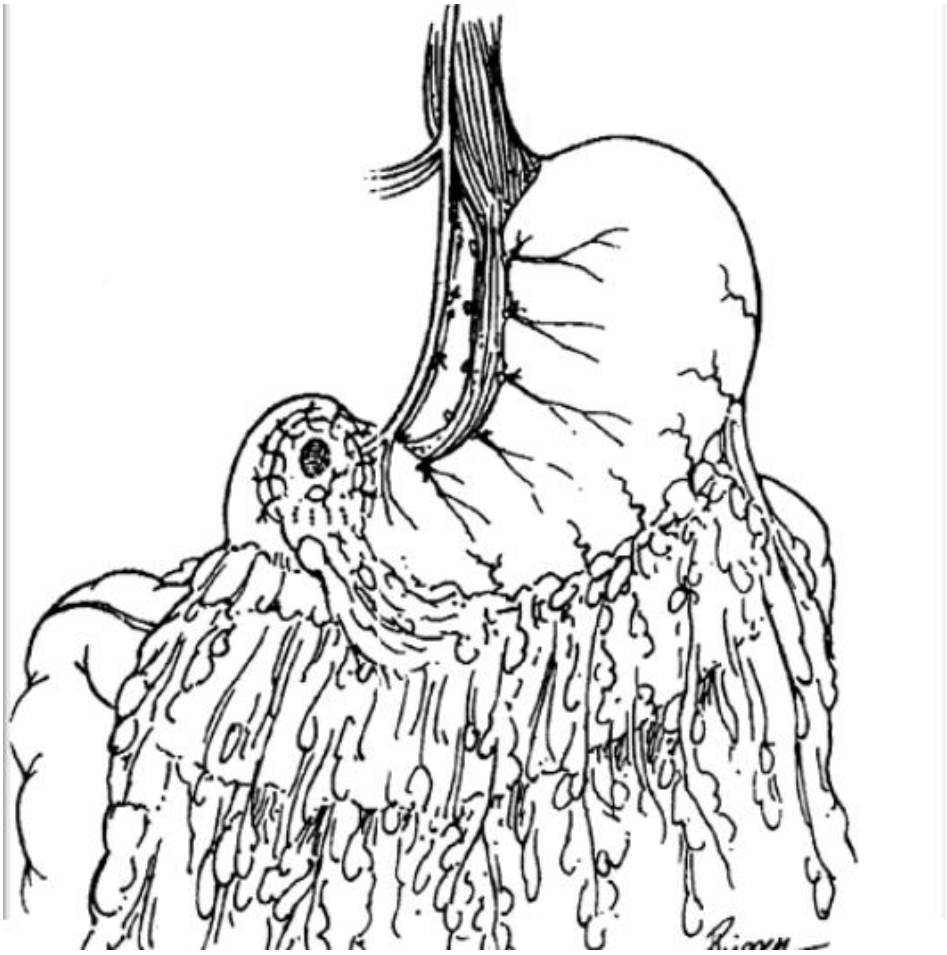
omentum will not be as intimately applied to the duodenal perforation and may not represent as good a seal as is the case when the omentum is laid directly on the open ulcer bed (Fig. 5B). With chronic duodenal ulcer and considerable scarring in the edge of that ulcer, it would be difficult to tie the sutures and approximate the edges of the ulcer, as the fibrotic ulcer, especially with larger perforations (1.0 cm or larger), is a large enough defect that the sutures are apt to tear through the ulcer edge in trying to close the ulcer. It is neither necessary nor desirable to try to sew the ulcer shut, but rather the omental pedicle graft is quite efficient in sealing the perforation and preventing any further escape of duodenal fluid into the peritoneal cavity. The laparoscopic method of closing the perforated ulcer is very similar to the illustration of holding the patch in place by a different technique than the full-thickness duodenal suture; this uses interrupted Lembert sutures to hold the omental patch in place without attempting to enter the duodenal lumen with any stitch. The only difficulty with this procedure, primarily when using the laparoscope, is that the inferior portion of the omental patch may be difficult to secure to the duodenum, especially if the more superior Lembert sutures are placed and tied first. These inferior sutures are represented in the diagram by short interrupted lines, but they are meant to represent the same type of sutures that encompass the rest of the circumference of this patch and are readily placed in the inferior duodenal wall before the more superior sutures are. They're located just below the perforation with the open procedure.

Although it is sometimes done, tying the sutures to close the perforation prior to placing the omentum at the defect has the disadvantage of preventing broad apposition of the omentum to the duodenal serosa. Further, there is a potential or actual space between the duodenal serosa and the omentum. If the sutures are tied after the omentum is in place, with no

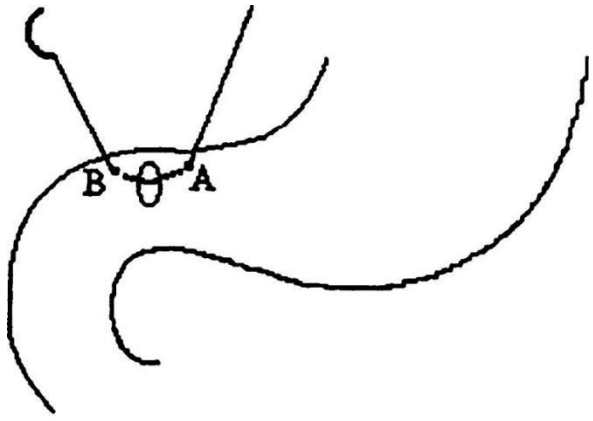
attempt to sew the ulcer perforation closed, the omentum will effectively plug the perforation. Step 2 of this operation, after the ulcer perforation has been closed, is meticulous irrigation of the peritoneal cavity, first by copious irrigation with at least 8 to 10 L of previously warmed saline solution. In practice, 1 to 2 L of irrigant saline solution, previously warmed to at least 90°F, is instilled and then aspirated; another 2 L of similar solution is instilled, again aspirated, until 10 L or so of warmed saline solution has washed the various recesses of the abdominal cavity. Any fenestrated suction tip is appropriate and special attention should be paid to the infrahepatic, suprahepatic, subphrenic, perisplenic, and retrogastric spaces. The easiest way to introduce the suction tip into the lesser peritoneal sac is gently, by blunt finger dissection to open the gastro hepatic omentum, ordinarily without any significant bleeding. If necessary, cautery can be used to open the sac. The suction tip can then be introduced behind the stomach to be sure to obtain fluid that may be contained in the lesser sac better.



Perforated duodenal ulcer patch closure has, at least in North America, come to be called the Graham closure, first described by Roscoe Graham in 1938. Modifications have been proposed, and will be discussed, but the open approach to perforated duodenal ulcer has proven to be successful in the vast majority of patients (Fig. 2). The perforated ulcer is identified either through the open incision or by laparoscope. In the open approach, laparotomy pads are placed around the perforation to contain any further spill while the sutures are being placed and then the omental tongue is brought into position. Three, sometimes four, sutures are used, preferably of non absorbable material, although poly dioxanone suture (PDS) is quite satisfactory. A small, half-circle needle with the swaged-on suture is placed through the edge of the defect, approximately 0.5 to 1.0 cm from the edge of the perforation.

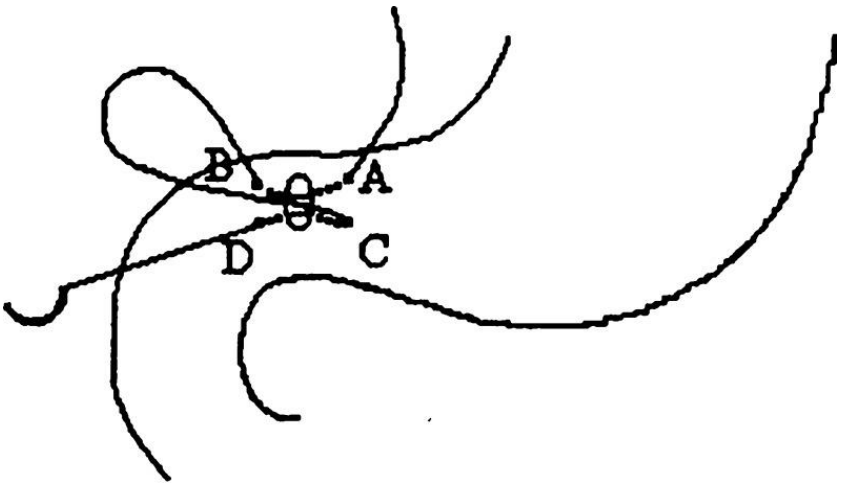


A new option was tried, that is, the suture was applied a bit away from the edge and a figure-of-8 was made as follows: the needle was passed into the duodenum at some distance away from the ulcer (Figs. 1, ,2,2, ,3,3, point A), taken out through the ulcer and then again passed through the ulcer into the duodenum and taken out through all layers of the walls of the duodenum on the distal side (point B). Now, these were not tied but the needle was taken to the proximal side of the ulcer (point C) and passed into the duodenum and taken out through the ulcer and again passed into the duodenum through the ulcer and taken out distally through the duodenal wall (point D). Now, the suture was tied to make it a figure-of-8. This technique was used in all cases and was found to be very effective. In case of a big ulcer, if required, additional one or more supporting simple stitches were applied on one or both the sides of the figure-of-8 suture, depending on the size of the ulcer. This additional stitch or stitches did not tend to cut through because the edges of the ulcer were already approximated by the figure-of-8 suture. The closed ulcer was covered by live omentum and sutures were applied to the stomach and the duodenum wall to fix the omentum to cover the ulcer area. The suture material used was atraumatic silk. All the patients but one of the studied cases recovered without any reperforation



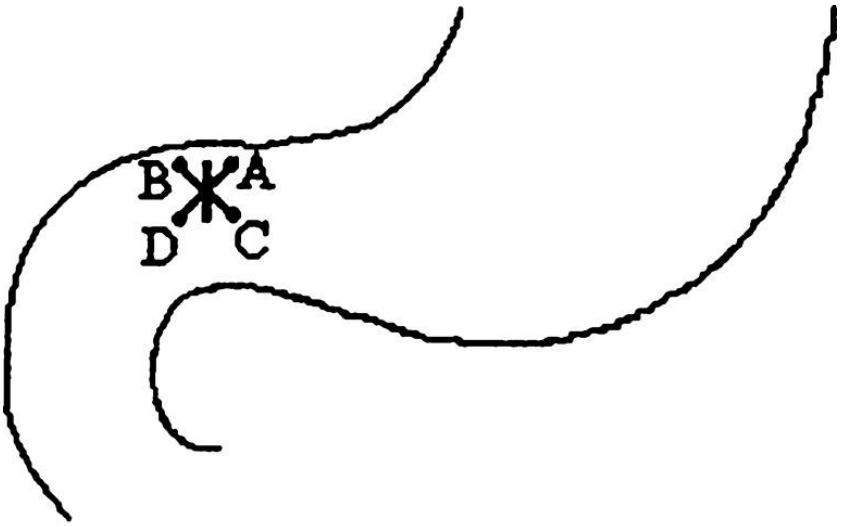
I

First step of closure of peptic ulcer perforation



II

Second step of closure of perforation to make figure-of-8



III

Closure of peptic perforation by figure-of-8 suture completed

The following advantages were found with this technique:

1. The suture can be taken from a relatively longer distance by even a small needle.

2. There is lesser tendency to cut through because the pressure at one point is divided into two directions, and the pressure is exerted on four points instead of two points. When a simple stitch is applied, there are more chances of cut through the friable and oedematous walls because pressure is directed towards one point

3. The edges of the ulcer do not tend to evert by the effect of the figure-of-8 stitch and approximation of edges has been found to be satisfactory

4. The cross of the figure-of-8 comes over and supports the most friable and oedematous central part of the ulcer.

LAPAROSCOPIC VERSUS OPEN APPROACH

Recent publications from centers where large numbers of laparoscopic procedures are performed, specifically omental patch closure of the perforation, are reporting insignificant time differences between the open procedure and the laparoscopic procedure. Although the cost of the instrumentation is considerably higher with the laparoscopic procedure, that is compensated for in that patients who have laparoscopic perforated ulcer operations spend less time in the hospital, use less by way of postoperative narcotic analgesics, and have a negligible incidence of port site infection, definitely less than the wound infection rate in patients who have been subjected to open laparotomy.

The practice of postoperative peritoneal lavage as a mechanical method of removing debris and fluid that was not retrieved at the time of operation had a period of popularity in the 1990s, but that has subsided. Peritoneal dialysis catheters were inserted into each flank during the operation and continuous lavage and aspiration of 1 to 2 L/h during the first 24 to 48 hours post operatively required almost continuous nursing care. In current practice, this measure is rarely employed. Another practice that is slowly but surely falling into disfavor is the use of peritoneal drains not for lavage, but to drain the general peritoneal cavity. None would drain an abscess without leaving a drain in the abscess cavity, but trying to drain the general peritoneal cavity is different. Drains are generally quickly walled off and don't function for long. Also, drains are a two-way street, as they may facilitate entry of bacteria from the outside into the inflamed peritoneal cavity, and meticulous care of the drains is required to achieve anything like acceptable protection of the peritoneal cavity while the drain is in place.

Although not routinely used, a small cohort of patients with diffuse peritonitis, and particularly those with systemic sepsis, will be well served by having a tube jejunostomy for postoperative feeding as well as a tube gastrostomy for aspiration of the stomach. These are primarily elderly, debilitated, and often, at least initially, hemodynamically unstable patients who are aggressively resuscitated and then operated on. Because the complication rate in these patients is substantially higher than in the general population of perforated ulcer patients, it can save considerable time and trouble and protect the patient against intestinal bacterial translocation if a feeding jejunostomy tube is appropriately placed. This operation is described elsewhere, but briefly, a rubber urethral catheter of 20 French size is used, several extra holes are cut in this tube, and, importantly, the whistle tip of the tube is cut off, so that if the tube has to be replaced for any reason, it can be done over a guidewire that is introduced into the bowel through the jejunostomy tube. Then the tube can be removed and a new tube inserted. We prefer the Witzel tunnel to secure that tube and do not sew it to the peritoneum; a popular alternative is to place the tube through one or two purse-string sutures and tack the loop of jejunum into which the tube has been placed to the parietal peritoneum adjacent to the tube exit site, using three or four absorbable sutures. The use of duodenostomy in very large perforated peptic ulcers is to be discouraged since inability to achieve secure closure of the perforated ulcer essentially requires that the duodenum be transected at the ulcer site and closed, and an antrectomy and truncal vagotomy be done with a Billroth II anastomosis. If a duodenal drainage tube is deemed necessary, a tube can be inserted through a proximal jejunostomy at the ligament of Treitz; the tube is gently fed proxima until the tip is palpated in the descending duodenum. This is safer than making another hole in the already inflamed

duodenum, and would primarily be used in the patient with a difficult duodenal stump closure. Almost invariably, the incision is closed in one layer incorporating all layers of fascia and, ordinarily, peritoneum. Closure of the peritoneum is not necessary. A single strand of 0 or double strand of 3-0 suture material, nonabsorbable, is used. The double strand of suture increases the amount of fascia gripped by the suture without increasing the actual amount of foreign material left in the wound. The bites must be at least 2 cm from the cut edge of the fascia, and we prefer these to be interrupted; they are tied after four or six have been placed. The last few sutures in the incision are held and are also tied at the same time. Many surgeons use continuous suture closure with satisfactory results. Suture material currently preferred is polypropylene or polydioxanone. If the perforation is 12 hours old or less and the patient is on appropriate antibiotics, there is no question that skin and subcutaneous tissue can and should be closed with staples or even a dermal skin closure, provided that the closure is not too tight. On the other hand, if this has been a delayed operation and more than 12 hours have elapsed since the perforation occurred, we still feel more comfortable about leaving the skin and subcutaneous fat open so as to visualize the granulating wound edges and viable, uninfected fascia

DUODENUM ANATOMY

First Part (Superior): 5 cm long. The proximal half is mobile; the distal half is fixed.

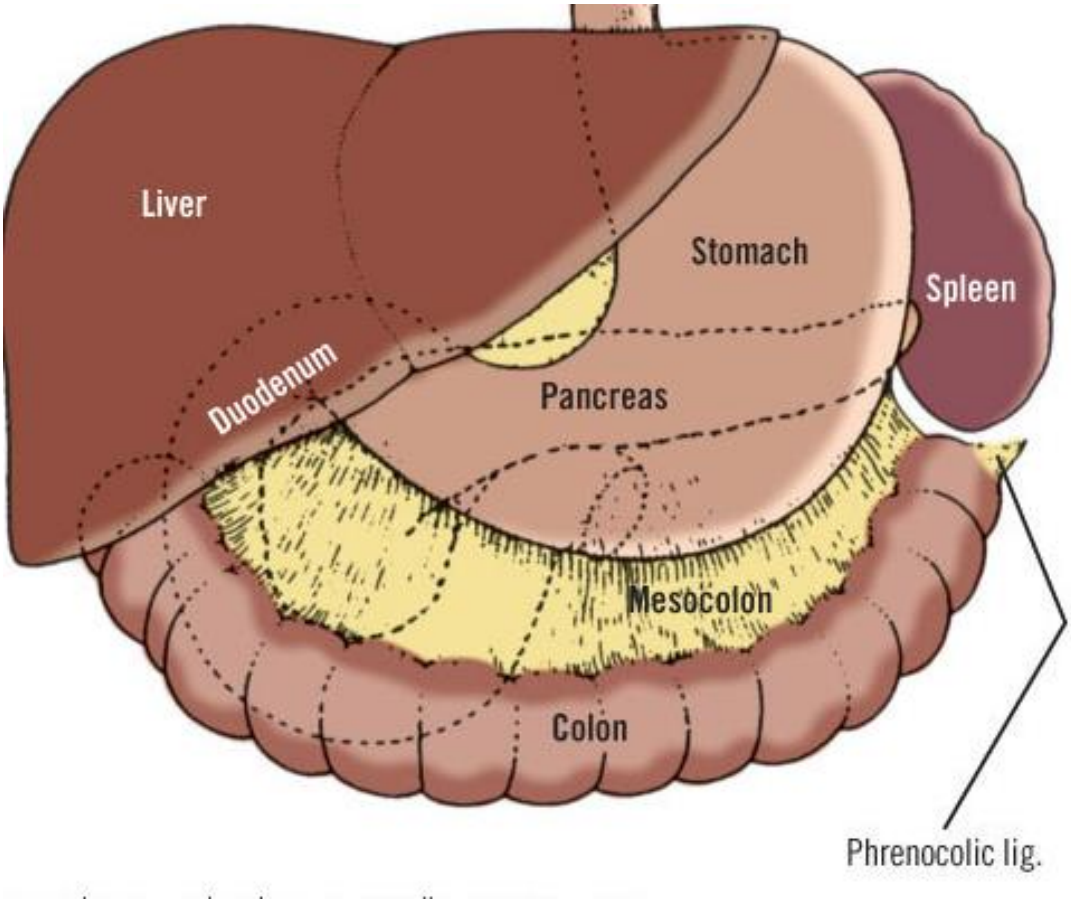
The duodenum passes upward from the pylorus to the neck of the gallbladder . It is related

(1) posteriorly to the common bile duct, portal vein, inferior vena cava, and gastroduodenal artery

(2) anteriorly to the quadrate lobe of the liver

(3) superiorly to the epiploic foramen

(4) inferiorly to the head of the pancreas.



The initial 2.5 cm is freely movable and is covered by the same two layers of peritoneum that invest the stomach. The hepatoduodenal portion of the lesser omentum attaches to the superior border of the duodenum; the greater omentum attaches to its inferior border. The distal 2.5 cm is covered with peritoneum only on the anterior surface of the organ, so that the posterior surface is in intimate contact with the bile duct, the portal vein, and the gastroduodenal artery. The duodenum is separated from the inferior vena cava by a small amount of connective tissue.

Second Part (Descending): 7.5 cm long. It extends from the neck of the gallbladder to the upper border of L4.

This part of the duodenum is crossed by the transverse colon and the mesocolon and consists, therefore, of a supramesocolic portion and an inframesocolic portion. The parts above and below the attachment of the transverse colon are covered with visceral peritoneum. The first and second parts of the

duodenum join behind the costal margin a little above and medial to the tip of the ninth costal cartilage and on the right side of the first lumbar vertebra.

The second part of the duodenum forms an acute angle with the first part, and descends from the neck of the gallbladder anterior to the hilum of the right kidney, the right ureter, the right renal vessels, the psoas major, and the edge of the inferior vena cava. It is related anteriorly to the right lobe of the liver, the transverse colon, and the jejunum. At about the midpoint of the second part of the duodenum, the pancreaticobiliary tract opens into its concave posteromedial side. The right side is related to the ascending colon and the right colic flexure.

Third Part (Horizontal or Inferior): 10 cm long. It extends from the right side of L3 or L4 to the left side of the aorta.

The third part of the duodenum begins about 5 cm from the midline, to the right of the lower end of the third lumbar vertebra, at about the level of the subcostal plane. The third, or transverse, part passes to the left, anterior to the ureter, the right gonadal vessels, the psoas muscle, the inferior vena cava, the lumbar vertebral column, and the aorta. It ends to the left of the third lumbar vertebra.

This inframesocolic portion of the duodenum is covered anteriorly by the peritoneum. It is crossed anteriorly by the superior mesenteric vessels and, near its termination, by the root of the mesentery of the small intestine. The third part is related superiorly to the head and uncinate process of the pancreas. The inferior pancreaticoduodenal artery lies in a groove at the interface of the pancreas and the duodenum. Anteriorly and inferiorly, this part of the duodenum is related to the small bowel, primarily to the jejunum.

Fourth Part (Ascending): 2.5 cm long. It extends from the left side of the aorta to the left upper border of L2.

The fourth, or ascending, part of the duodenum is directed obliquely upward. It ends at the duodenojejunal junction to the left and at the level of the second lumbar vertebra at the root of the transverse mesocolon. This junction occurs at about 4 cm below and medial to the tip of the ninth costal cartilage. The fourth part is related posteriorly to the left sympathetic trunk, the psoas muscle, and the left renal and gonadal vessels. Its termination is very close to the terminal part of the inferior mesenteric vein, to the left ureter, and to the left kidney. The upper end of the root of the mesentery

also attaches here. The duodenojejunal junction is suspended by the ligament of Treitz, a remnant of the dorsal mesentery, which extends from the duodenojejunal flexure to the right crus of the diaphragm.

Pancreaticobiliary Structures

The fourth (intramural) portion of the common bile duct passes obliquely through the wall of the second part of the duodenum with the main pancreatic duct (Wirsung). Other associated structures are the major and minor papillae, the ampulla of Vater (if present), and the sphincteric mechanism of Boyden. Taken together, they form what Dowdy called the "Vaterian system."[24] This term expresses the anatomic and surgical unity of these structures, but has no functional significance.

The terminal portion of the common bile duct passes through the duodenal wall; it is about 1.5 cm in length, and narrows from 1.0 cm extramurally to 0.54 cm at the papilla. The main pancreatic duct enters the duodenum caudal to the bile duct, also decreasing in diameter. The ducts usually lie side by side, with a common adventitia for several millimeters. The septum between them becomes reduced to a mucosal membrane before actual confluence is reached.

Major Duodenal Papilla

There is confusion in the literature regarding the true definitions of the terms papilla of Vater and ampulla of Vater. The papilla of Vater, which should be called the major duodenal papilla, is a nipplelike formation and projection of the duodenal mucosa through which the distal end of the ampulla of Vater passes into the duodenum. The ampulla of Vater (hepatopancreatic), with its several formations, is the union of the pancreaticobiliary ducts.

The major papilla is on the posteromedial wall of the second (descending) portion of the duodenum to the right of the second or third lumbar vertebra. In older patients, it may lie at a slightly lower level. The distance from the pylorus varies from 7 to 10 cm, with extremes of 1.5 to 12 cm. The distance is decreased in the presence of inflammation of the cap or the postbulbar region of the duodenum.

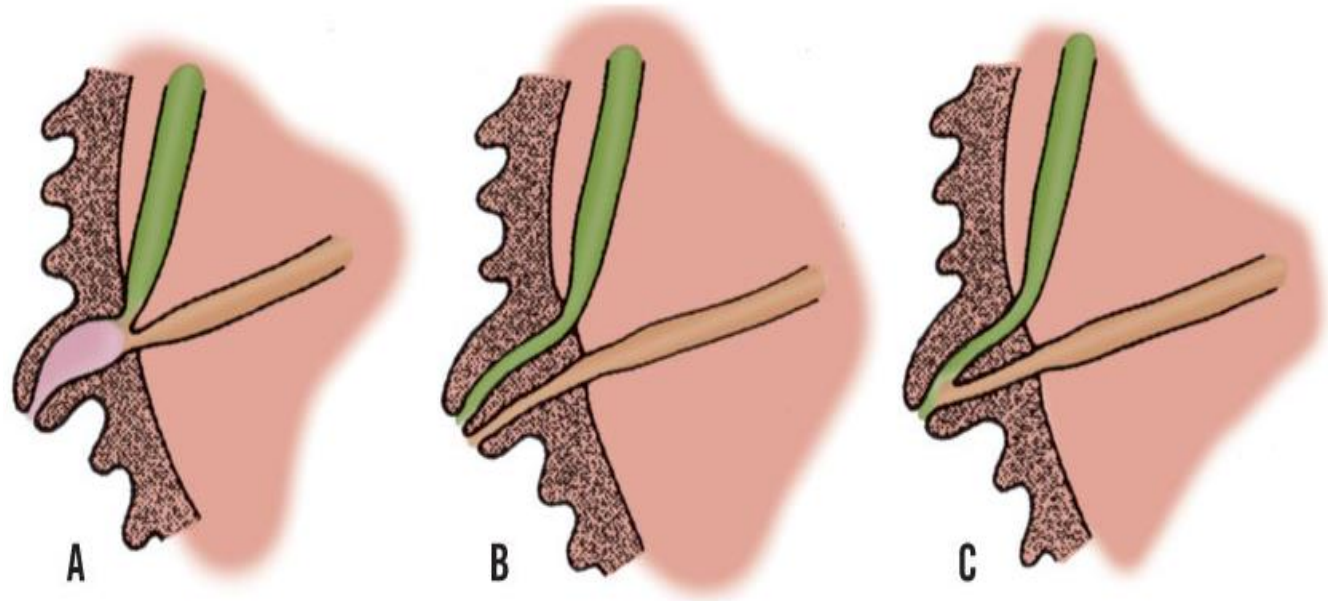
Viewed from the mucosal surface, the papilla (Fig. 16-8) may be hard to locate because of the mucosal folds; sometimes it is completely overlaid by a transverse fold of duodenal mucosa. Its oval or slitlike orifice lies at its tip, the posterior end of which projects downward, and raises a longitudinal fold, known as the plica longitudinalis. The orifice is frequently filled by villus like projections called

valvules, or valvulae. Occasionally, a diverticulum lying near the papilla can cause difficulty for the surgeon or the endoscopist.

AMPULLA OF VATER

The ampulla is a dilatation of the common pancreaticobiliary channel within the papilla and below the junction of the two ducts (Fig. 16-9A). If a septum is present as far as the duodenal orifice, the ampulla is said to be absent (Fig. 16-9B). Michels[25] collected the findings of 25 investigators in 2500 specimens and concluded that an ampulla was present in 63 percent of cases. By definition, an ampulla was said to be present if the edge of the septum between the two ducts fell short of the tip of the papilla. Actual measurements of the distance between the septal edge and the papillary tip range from 1 to 14 mm, with 75 percent being 5 mm or

less



Purists would require a dilatation of the common channel before they would apply the term ampulla. Where the common channel is less than 5 mm long, there is little or no dilatation.[27] In such specimens, the presence of a true ampulla becomes a matter of opinion (Fig. 16-9C). We agree with Michels[25] that the following classification is the most useful:

Type 1. The pancreatic duct opens into the common bile duct at a variable distance from the opening in the major duodenal papilla. The common channel may or may not be dilated (85 percent).

Type 2. The pancreatic and bile ducts open close to one another but separately on the major duodenal papilla (5 percent).

Type 3. The pancreatic and bile ducts open into the duodenum at separate points (9 percent).

A true dilated ampulla is present in about 75 percent of individuals of type 1, and is absent in types 2 and 3.

The variations in the distance between the pancreaticobiliary junction and the duodenal lumen result from developmental processes.[28] In the embryo, the main pancreatic duct arises as a branch of the mon bile duct, which in turn arises from the duodenum. Growth of the duodenum absorbs the proximal bile duct up to its junction with the pancreatic duct. When the resorption is minimal, there is a long ampulla, and the junction of the ducts is high in the duodenal wall (type 1), or even extramural. With increased resorption of the terminal bile duct, the junction lies closer to the duodenal orifice and the ampulla is shortened. The maximum resorption results in separate orifices for the main pancreatic duct and the common bile duct (type 3).

Sphincter of Boyden

A complex of several sphincters, composed of circular or spiral smooth muscle fibers, is found around the intramural part of the common bile duct, the main pancreatic duct, and the ampulla, if present. This sphincteric complex is called the sphincter of Boyden.[29] The muscle fibers have an embryonic origin .Like the papilla of Vater, another example of a misnamed anatomic entity is the sphincter of Oddi at the duodenal end of the pancreatic and common bile ducts. By priority of description, it should have been named for Francis Glisson.[30] In 1654 he described anular fibers around the entire intramural portion of the bile duct, and believed that they guarded the opening against the reflux of the contents of the duodenum. Glisson's account of his work is found in Boyden.[31]

Minor Duodenal Papilla

The minor papilla, through which the accessory pancreatic duct (Santorini) opens, is about 2 cm cranial and slightly anterior to the major papilla. It is smaller and less easily identified than the major papilla. The most useful landmark is the gastroduodenal artery, behind which lies the accessory duct and the minor papilla. Duodenal dissection for gastrectomy should end proximal to the artery. The minor papilla may contain no duct or only a microscopic, tortuous channel. A true sphincter (of Helly) is rarely present. In about 10 percent[32] of individuals, the duct of Santorini is the only duct draining most of the pancreas. Accidental ligation of this duct, together with the gastroduodenal artery, would result in catastrophic pancreatitis.

Duodenal "Sphincters"

The debates concerning the so-called duodenal sphincters remind the authors of the controversy surrounding the gastroesophageal sphincters in regard to their anatomic or physiologic existence and their relation to duodenal pathology. The authors' knowledge about duodenal sphincters was obtained from the excellent book by DiDio and Anderson, *The "Sphincters" of the Digestive System*.[33] In addition to the well-known gastroduodenal pyloric sphincter, the duodenum has the following controversial sphincters:

The first duodenal sphincter is said to be located at the distal end of the duodenal bulb and is perhaps related to, if not responsible for, segmental achalasia and "megabulb."

The sphincter of Villemin is proximal to the ampulla of Vater.[34,35]

If the so-called "Ochsner muscle" exists, it is probably located below the ampulla of Vater, according to Ochsner, who presented his findings in two publications in 1906.[36] In 1907, Boothby expressed doubt as to the existence of the sphincter.[37] A sphincter just proximal to the duodenojejunal flexure was also described by both Ochsner and Villemin.

In the introduction to his book about Antonio Scarpa, Monti stated: "Like the poet, and perhaps even more so, the scientist is the product of the period in which [he] lives."[38] It may be that the period in which Ochsner, Boothby, and Villemin lived stimulated them to perform their investigative work. The authors of this chapter agree with DiDio and Anderson that the descriptions of the sphincteric component are vague and that their clinical significance is nonexistent.

Vascular Supply

Arteries

The blood supply of the duodenum is confusing due to the diverse possibilities of origin, distribution, and individual variations (Fig. 16-11, Fig. 16-12, Fig. 16-13). This is especially true of the blood supply of the first portion of the duodenum. In his fine presentation about the stomach and the duodenum, Griffith[39] warned surgeons to be very cautious, because of these variations of the main arteries. Akkinis[40] stated that there is no collateral circulation beyond the terminal arcades of the small bowel. Do we have the same phenomenon in the first portion of the duodenum? What about the anemic spot of Mayo that corresponds to the distribution of the supraduodenal artery? Does it exist? Do the variations of the above-named arteries represent, as Griffith states, an underlying factor in necrosis and leakage? The authors of this chapter do not want to take a position on these questions. Our only advice

is to use good surgical technique when surgery is definitely required, and not take an overenthusiastic approach when dealing with benign disease.

The first part of the duodenum is supplied by the supraduodenal artery (Fig. 16-11) and the posterior superior pancreaticoduodenal branch of the gastroduodenal artery (retroduodenal artery as described by Edwards, Michels, and Wilkie), which is a branch of the common hepatic artery. In many individuals, the upper part of the first 1 cm is also supplied by branches of the right gastric artery. In some individuals, one may see separate small branches to the superior and posterior aspects of the first part of the duodenum; they can be properly called supraduodenal and retroduodenal, respectively. Each may arise separately, or in various combinations. It is preferable, therefore, that the term retroduodenal not be used as a synonym for the posterior superior pancreaticoduodenal branch, the principal role of which is to supply the second part of the duodenum and pancreatic head. *Nomina Anatomica* (6th ed)[41] also acknowledges the separate identity of the supraduodenal, retroduodenal, and posterior superior pancreaticoduodenal arteries; the supraduodenal artery is frequently absent, however.

After giving origin to the supraduodenal, retroduodenal, and posterior superior pancreaticoduodenal branches, the gastroduodenal artery descends between the first part of the duodenum and the head of the pancreas. It terminates by dividing into the right gastroepiploic and anterior superior pancreaticoduodenal arteries, both supplying twigs to this part of the duodenum.

The remaining three parts of the duodenum are supplied by an anterior and a posterior arcade. From the arcades spring pancreatic and duodenal branches. Those supplying the duodenum are called arteriae rectae; they may be embedded in the substance of the pancreas. Four arteries contribute to the pancreaticoduodenal vascular arcades:

1. The anterior superior pancreaticoduodenal arteries, commonly two in number, arise from the gastroduodenal artery on the ventral surface of the pancreas.
2. The posterior superior pancreaticoduodenal (retroduodenal) artery usually crosses in front of the

common bile duct. The artery then spirals to the right and posterior to the duct, descending deep to the head of the pancreas. Several of the retroduodenal artery branches anastomose inferiorly with rami from the posterior branch of the inferior pancreaticoduodenal artery.

3 & 4. Anterior inferior and posterior inferior pancreaticoduodenal arteries arise from the superior mesenteric artery or its first jejunal branch, either separately or from a common stem. Blood reaches the concave surface of the duodenum by the vasa recta from the pancreaticoduodenal arcades. At first supplying the muscularis externa, they form a large plexus in the submucosa, from which arteries pierce the muscularis mucosae and form a second rich plexus just beneath the epithelium of the villi. The surgeon should be sure to ligate only one of the two arcades, the superior or the inferior only. Lately, Hentati et al.[42] proposed a new classification of the arterial supply of the duodenal bulb , as follows:

The two arterial pedicles (infra- and supraduodenal) reach the bulb on its posterior aspect; each pedicle is made up of two sorts of blood currents (right and left); the posterior aspect of the bulb seems to be the most vascularized one, explaining, apart from bleeding from gastroduodenal [artery] erosion, the hemorrhagic character of ulcers of the posterior aspect of the bulb. The predominance of the left-hand currents explains the possible ischemia of the duodenal bulb and/ or rupture of the duodenal stump after their interruption

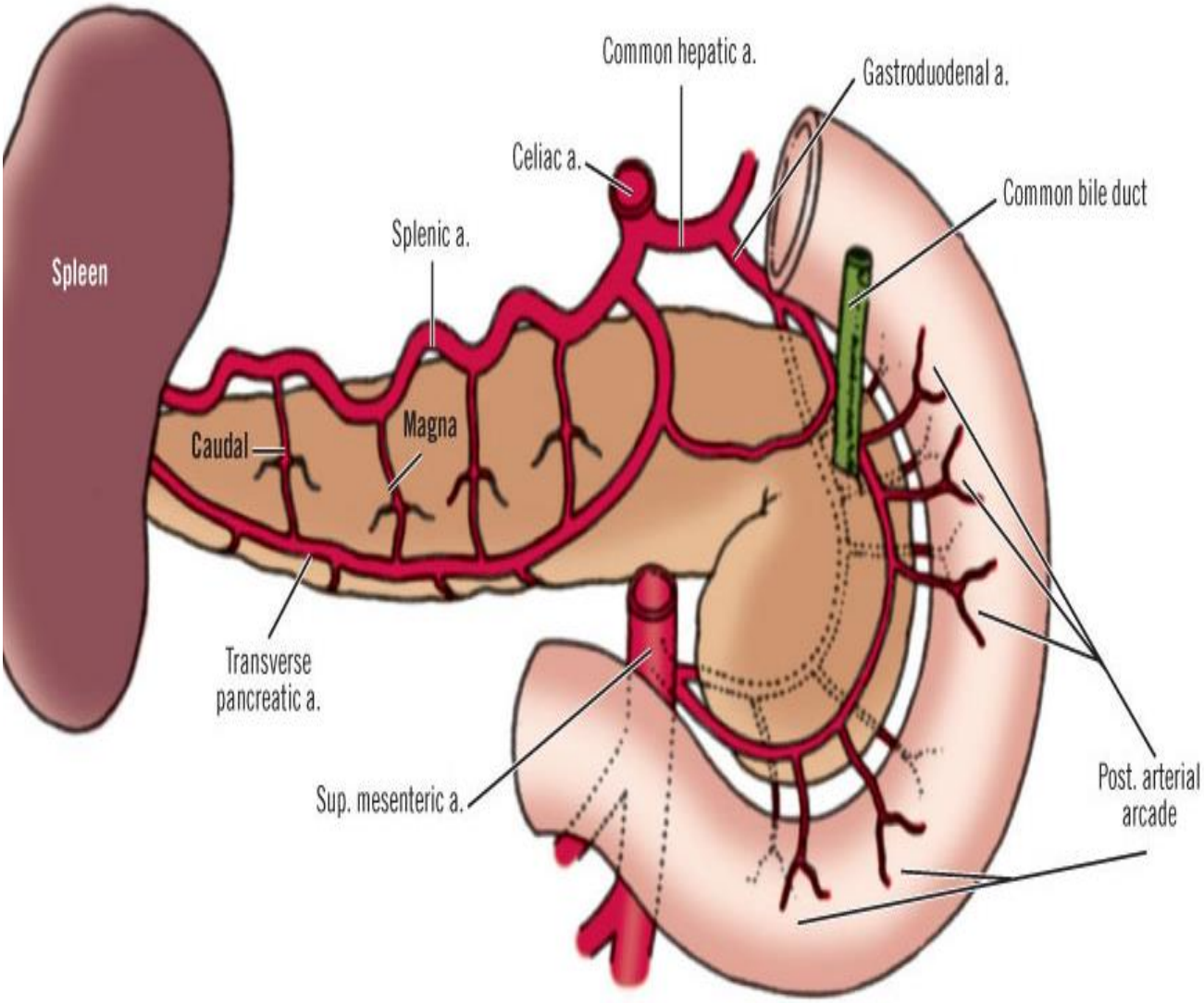
Veins

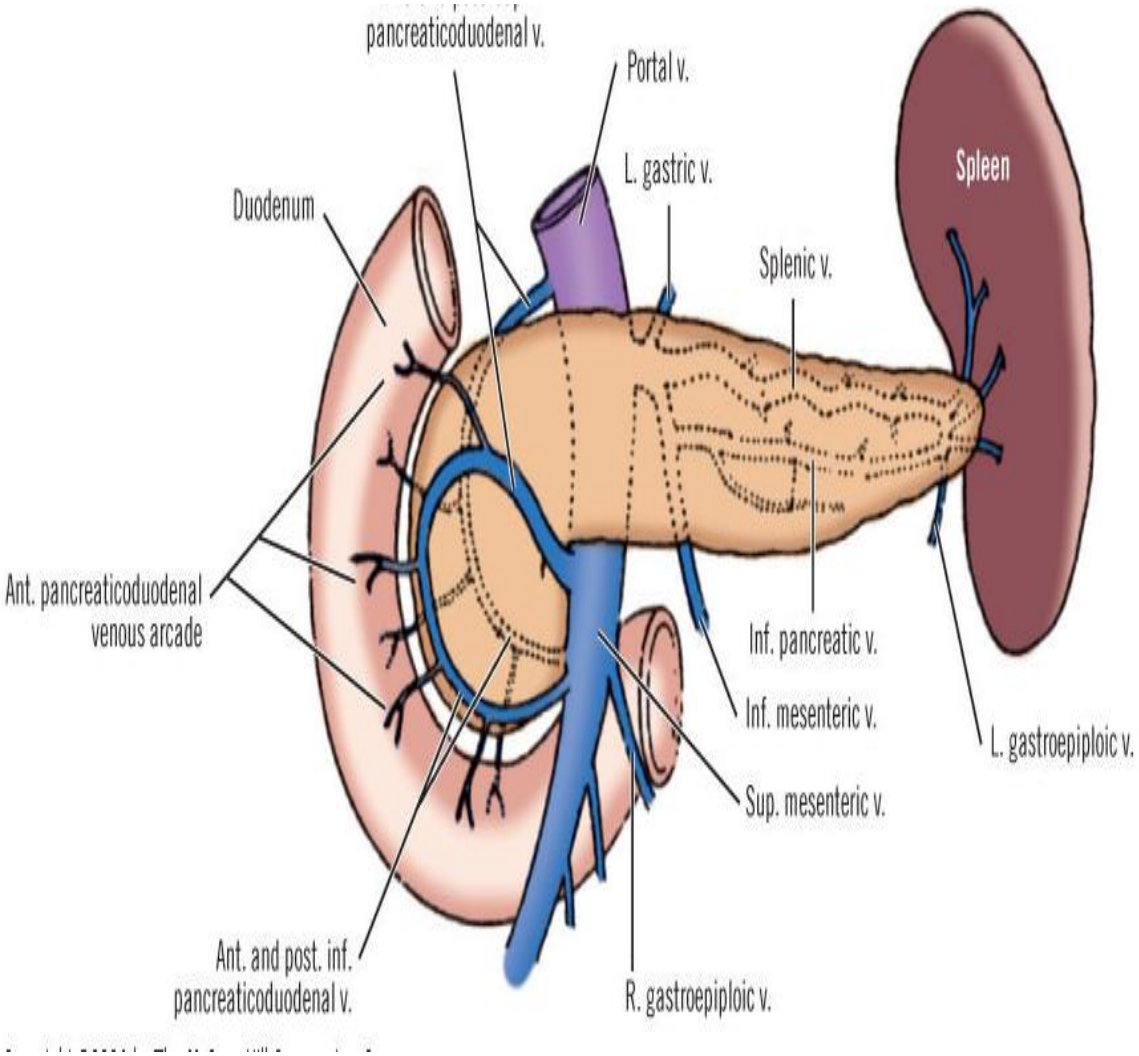
Veins of the lower first part of the duodenum and the pylorus usually open into the right gastroepiploic veins (Fig. 16-17); they are the subpyloric veins. The upper first part of the duodenum is drained by suprapyloric veins, which open into the portal vein or the posterior superior pancreaticoduodenal vein. Anastomoses between subpyloric and suprapyloric veins pass around the duodenum. One of these has been said to mark the site of the pylorus (prepyloric vein of Mayo).[43] It is not a constant indicator of the location of the pylorus

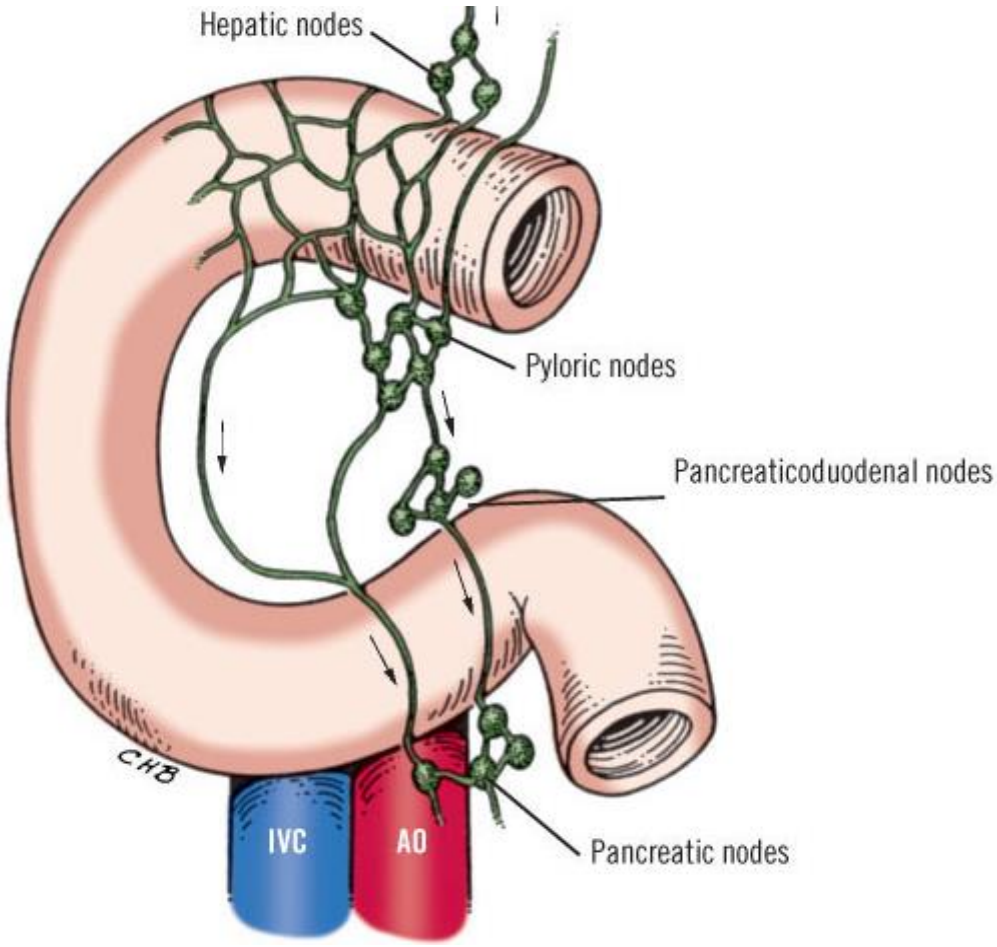
The venous arcades draining the duodenum follow the arterial arcades and tend to lie superficial to them. The anterior superior vein drains into the right gastroepiploic vein while the posterior superior vein usually passes behind the common bile duct to enter the portal vein. The inferior veins can enter the superior mesenteric (Fig. 16-18), the inferior mesenteric, the splenic, or the first jejunal vein. The veins may terminate separately or by a common stem

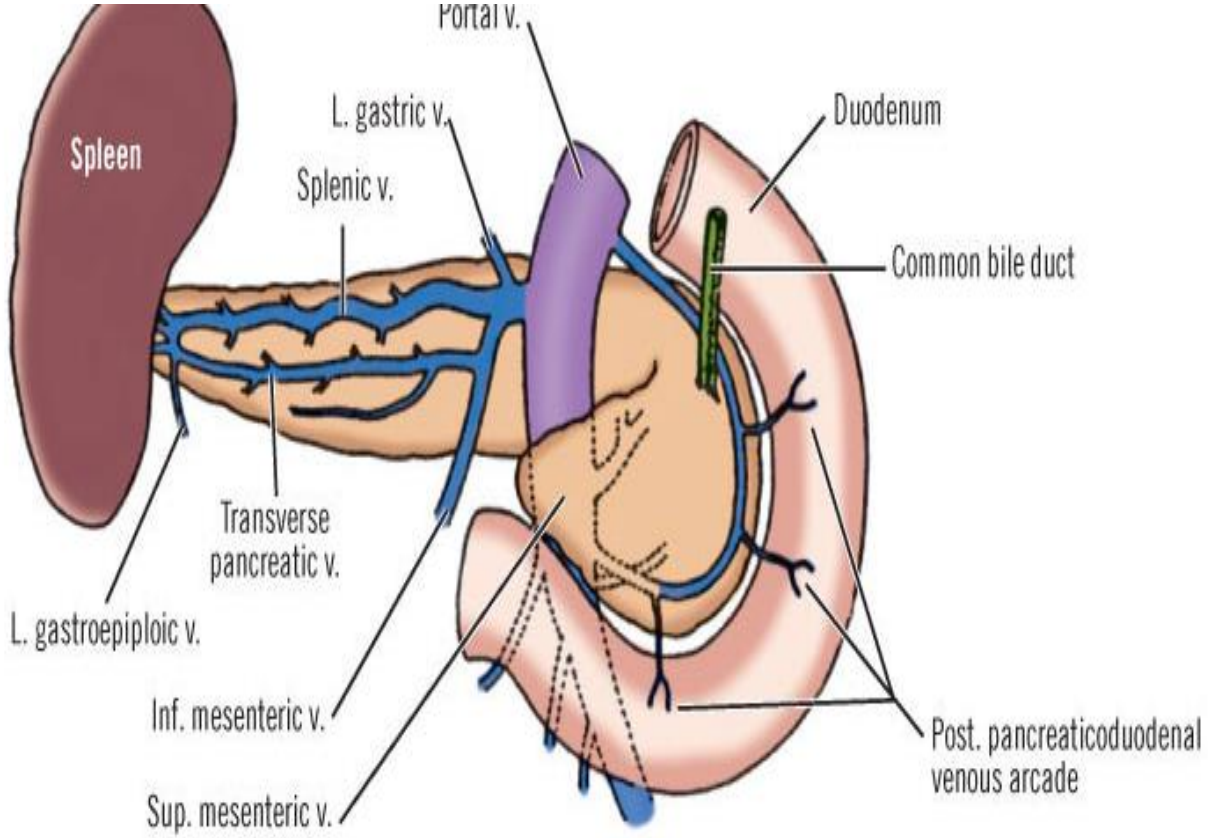
Lymphatics

The duodenum is richly supplied with lymphatics (Fig. 16-19). They originate as blind-ending vessels (lacteals) in each villus of the mucosa. These vessels form a plexus in the lamina propria and, piercing the muscularis mucosae, form a second submucosal plexus. Still another lymphatic plexus lies between the circular and longitudinal layers of the muscularis. Collecting trunks pass over the anterior and posterior duodenal wall toward the lesser curvature to enter the anterior and posterior pancreaticoduodenal lymph nodes



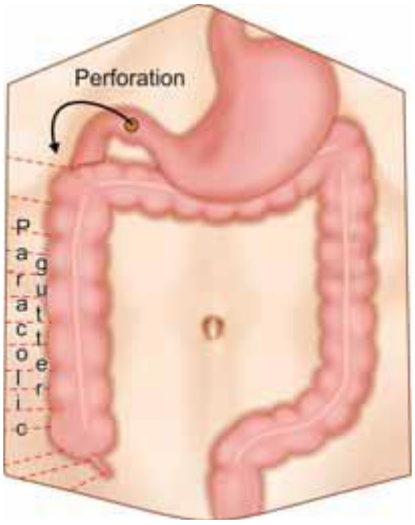

pancreaticoduodenal v.
Portal v.
L. gastric v.
Spleen
Duodenum
Splenic v.
Ant. pancreaticoduodenal
venous arcade
Inf. pancreatic v.
Inf. mesenteric v.
L. gastroepiploic v.
Sup. mesenteric v.
Ant. and post. inf.
pancreaticoduodenal v.
R. gastroepiploic v.


Hepatic nodes
Pyloric nodes
Pancreaticoduodenal nodes
Pancreatic nodes
IVC
AO
CHB

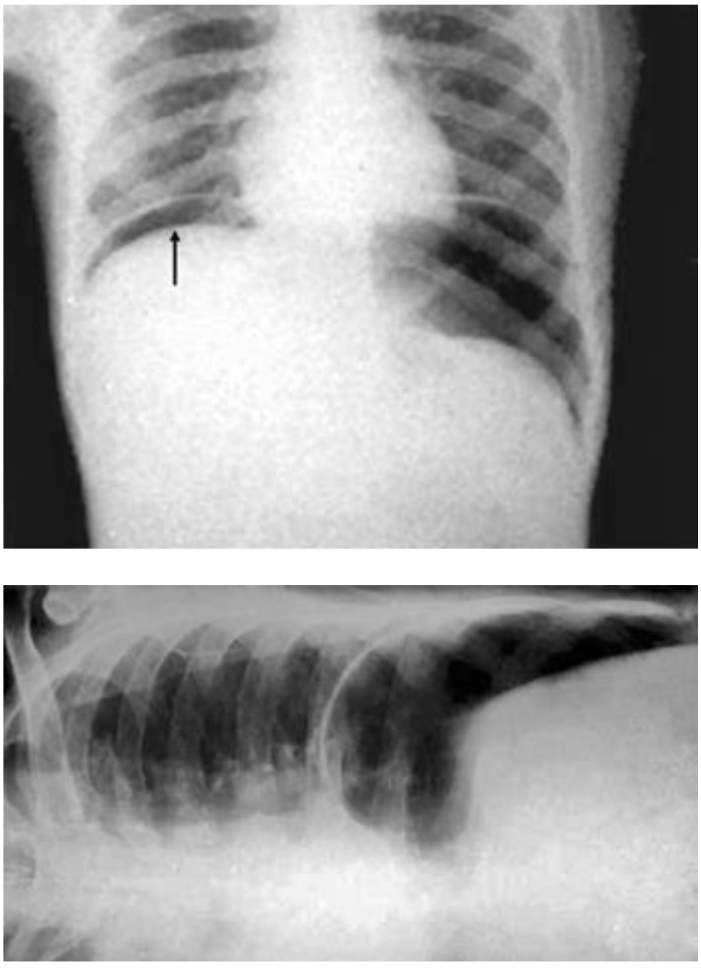

Portal v.
L. gastric v.
Duodenum
Spleen
Splenic v.
Common bile duct
Transverse
pancreatic v.
L. gastroepiploic v.
Inf. mesenteric v.
Post. pancreaticoduodenal
venous arcade
Sup. mesenteric v.

Innervation

Within the duodenal wall are the two well-known neural plexuses of the gastrointestinal tract, each of which is composed of groups of neurons interconnected by networks of fibers. One plexus (of Meissner) is in the submucosa; another plexus (of Auerbach) is in the connective tissue between the circular and longitudinal layers of muscularis externa. Some of the neuronal cell bodies and processes in the plexuses are assumed to be postganglionic parasympathetic. Several studies indicate that many are related (1) to circuitry for processing information received from various types of sensory receptors, (2) to synaptic complexes for directing neural outflow, and (3) to interconnecting neurons.[45] Preganglionic parasympathetic fibers in the plexuses are carried initially by the vagus nerves. Postganglionic sympathetic fibers arise from cell bodies located in the celiac and superior mesenteric ganglia, in sympathetic chain ganglia ranging from T-6 to T-12, or scattered along the course of the splanchnic nerves. The extrinsic nerve supply to the duodenum probably includes contributions which leave the anterior hepatic plexus close to the origin of the right gastric artery. In six out of 100 specimens examined by Skandalakis et al.,[46] nerves from the hepatic division of the anterior vagal trunk gave rise to one or more branches that innervated the first part of the duodenum. In most specimens, some branches could be traced upward toward the gastric incisura. The vagaries of the vagus are well known

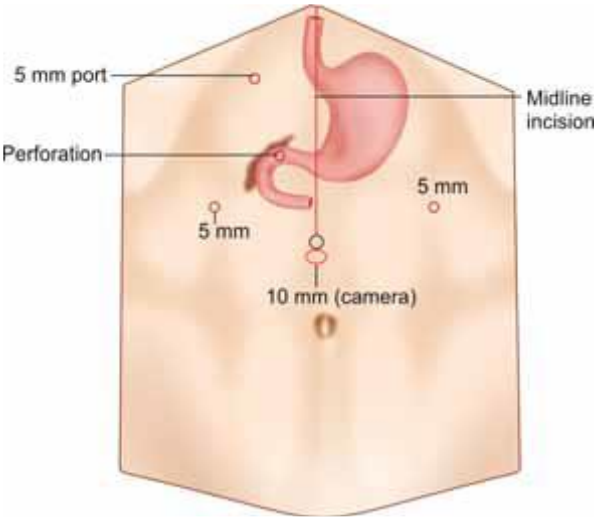


Duodenal ulcer perforation. Here fluid from perforated site travels along the right paracolic gutter



X-ray chest and upper abdomen or lateral decubitus

showing gas under diaphragm.



Incision for closure of perforated duodenum for open and laparoscopic approach

Once perforation is closed, either by open or laparoscopic method, after recovery, patient should be advised *anti-Helicobacter pylori* therapy (triple regime for 14 days) with PPI for 3 months. It reduces rate of reperforation and ulcer recurrence in duodenal ulcer.

In patients with severe peritonitis and critically ill, after perforation closure, it is better to insert a nasojejunal tube or feeding jejunostomy for nutrition in postoperative recovery period. Even if patient develops a temporary duodenal leak, this supports nutrition well until the leak stops.

METHODOLOGY

This is a prospective study comprising 50 patients of perforation peritonitis over a period of six months from March 2017 to August 2017. In this present study, the clinical material consists of patients admitted with perforation peritonitis in the Department of General Surgery, at Government Rajaji Hospital, Madurai.

METHOD OF COLLECTION OF DATA:

Sample size:

The size of sample work is 50 cases

Patients with odd in-patient who underwent figure of eight stitich for gastroduodenal perforations

Patient with even in-patient no. underwent graham omental patch for gastroduodenal perforations

Inclusion criteria:

Patients above 15 years of age

Cases of perforation peritonitis diagnosed to have gastroduodenal perforation

Patients consented for inclusion in the study according to the designated proforma.

Exclusion criteria:

Patients with perforation peritonitis in sites other than gastroduodenal perforation

Patients who underwent non operative management

Patients below 15 years of age

Patients not consented for inclusion in the study

The data will be collected in prescribed PROFORMA where in it contains, particulars of the patient, clinical history, clinical examination and diagnosis, relevant investigations, and details of surgery.

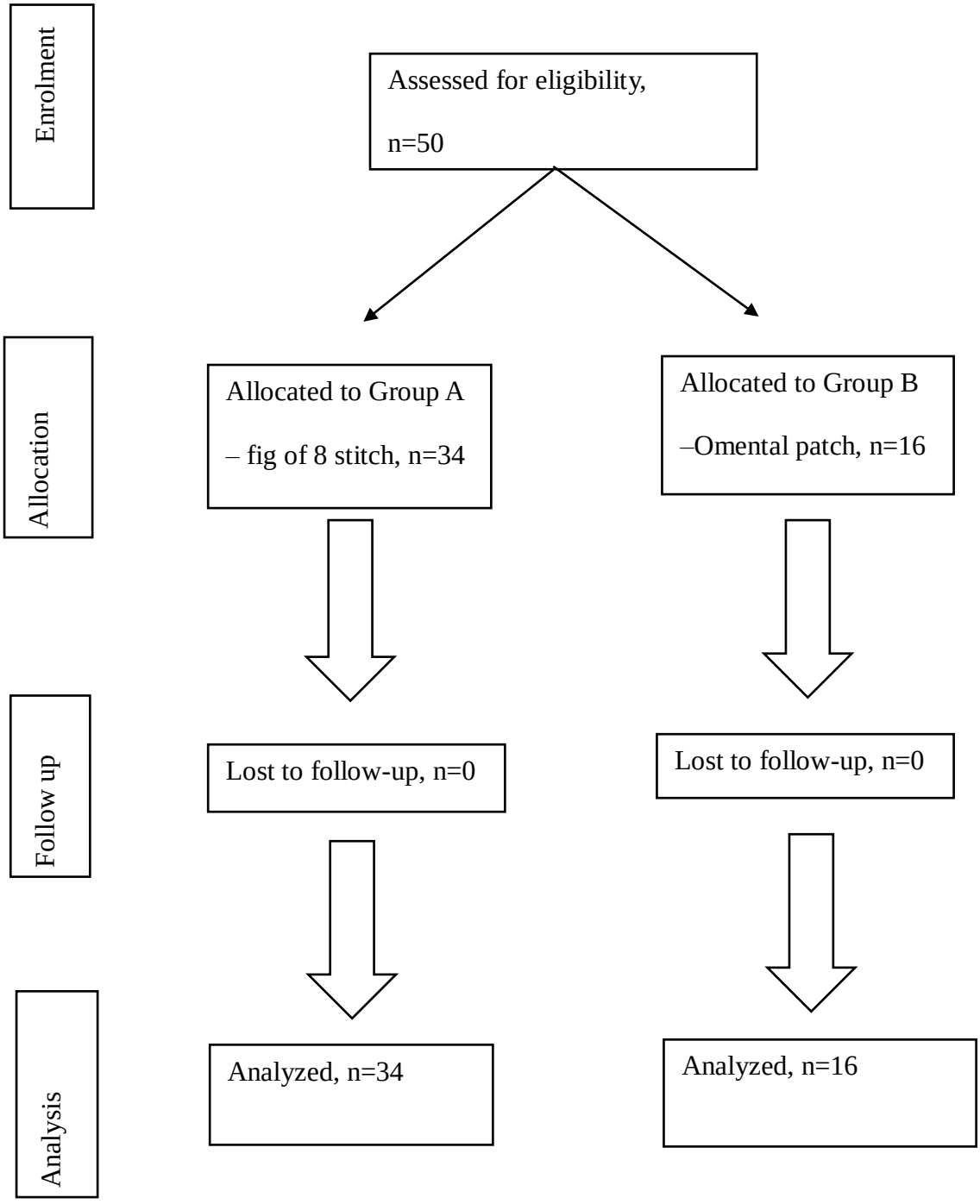
The patients were followed for three weeks in post-operative period for postoperative leak ,duration of surgery, postoperative morbidity and mortality.

Ethical clearance has been obtained from ethical committee of Government Rajaji Hospital, Madurai, prior to conducting the study.

Statistical analysis:

In this study, the results of the two groups were compared and analyzed by using Chi-square test.

CONSORT DIAGRAM



RESULTS AND OBSERVATION

In this "COMPARISON OF SURGICAL TECHNIQUES FOR GASTRO DUODENAL PERFORATION CLOSURE: A PROSPECTIVE STUDY OF FIGURE OF EIGHT CLOSURE VERSUS GRAHAM OMENTAL PATCH" conducted in Department of General Surgery at Government Rajaji Hospital, Madurai from March 2017 to August 2018, a total of 50 patients of perforation peritonitis who underwent Figure of Eight, were included in this prospective study, and randomized into two groups based on in-patient number. 34 patients with odd IP no in fig of 8 eight (Group A) and 16 patients with even IP no in omental patch (Group B) were considered for the study.

Procedure	No.of cases	Percentage
Figure of Eight	34	68.0
Omental patch	16	32.0
Total	50	100.0

In this study, age of the patients were more than 18 years. The youngest patient included in this study

series was 18 years, and the eldest was 74 years old. Almost 60% of the patients were in >50 age group.

Age in years	No.of cases	Percentage
< 30	6	12.0
31 - 40	7	14.0
41 - 50	7	14.0
51 - 60	15	30.0
> 60	15	30.0
Total	50	100.0

So perforation more often seen in elderly age groups,especially more than 50 years can be due to long term use of nsaids or chronic alcohol consumption.

Sex	No.ofcases	Percentage
Male	34	68.0
Female	16	32.0
Total	50	100.0

68% of the cases were males and 32% were females.more of elderly age groups.

Age in years	Figure of Eight	Omental patch
< 30	3	3
31 - 40	5	2
41 - 50	4	3
51 - 60	13	2
> 60	9	6
Total	34	16

Sex	Figure of Eight	Omental patch
Male	25	9
Female	9	7
Total	34	16

A total of 4 cases underwent Figure of Eight repair of which 25were males and 9 females.

Duration of surgery in minutes	Figure of Eight	Omental patch
< 1 hr (28)	20	8
> 1 hr (22)	14	8
Total	34	16
Mean	77.35	82.5
SD	49.07	50.86
p value	0.734 Not significant	

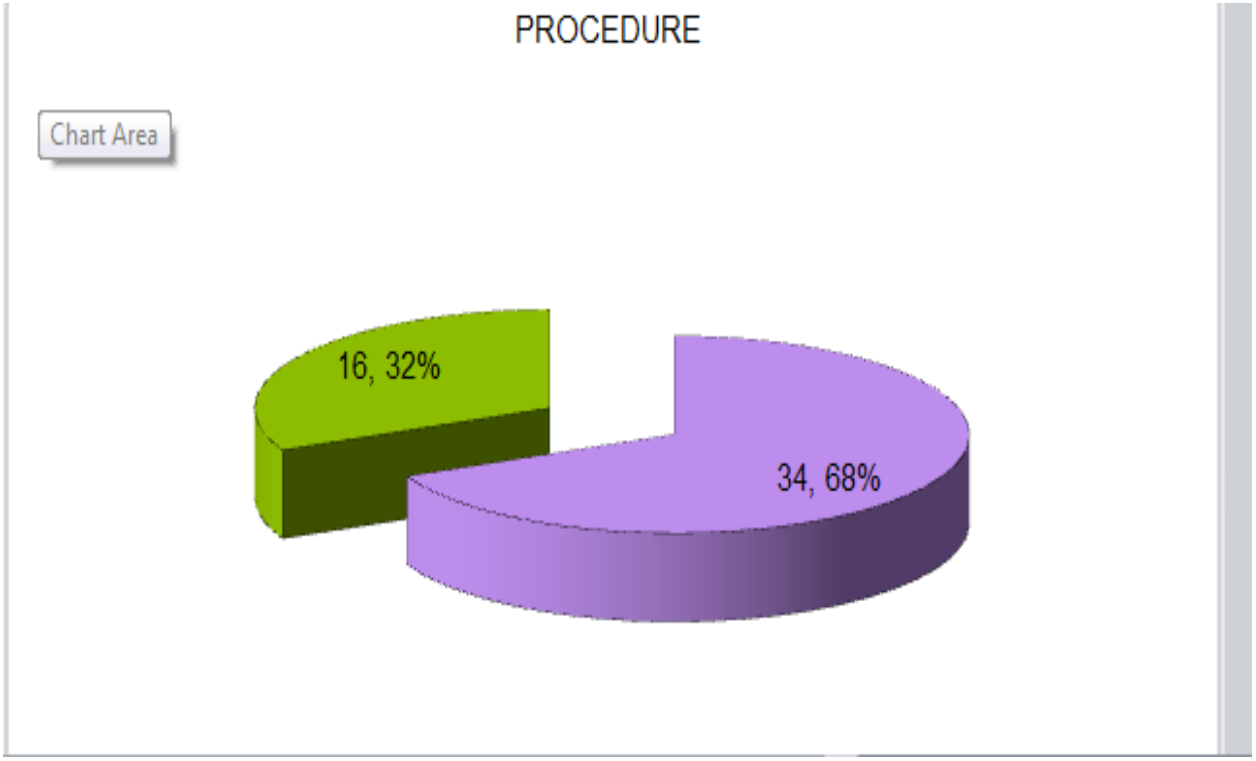
Duration of surgery does not have any significance as both the surgeries were having comparable limit,p value 0.734 not significant.

Post op Complications	Figure of Eight	Omental patch
Post op Leak	1	6
Mortality	0	3

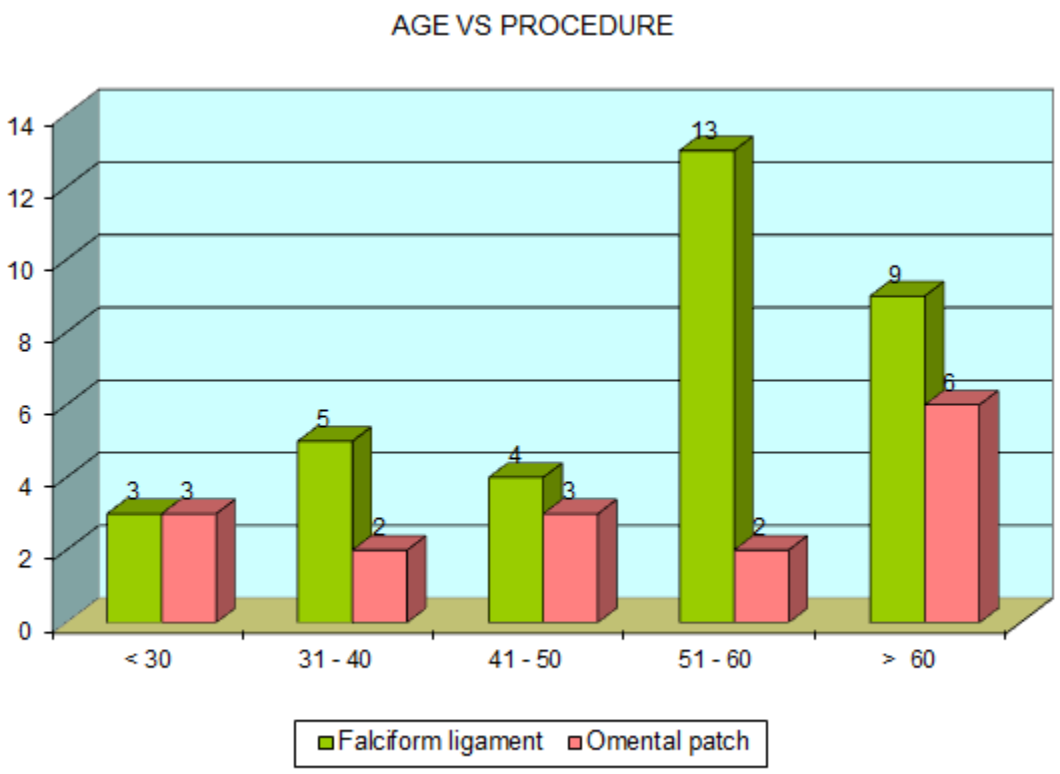
POSTOPERATIVE FOLLOW UP

Leak	1/34 vs 6/16	0.003	Significant
Mortality	0/34 vs 3/16	0.029	Significant

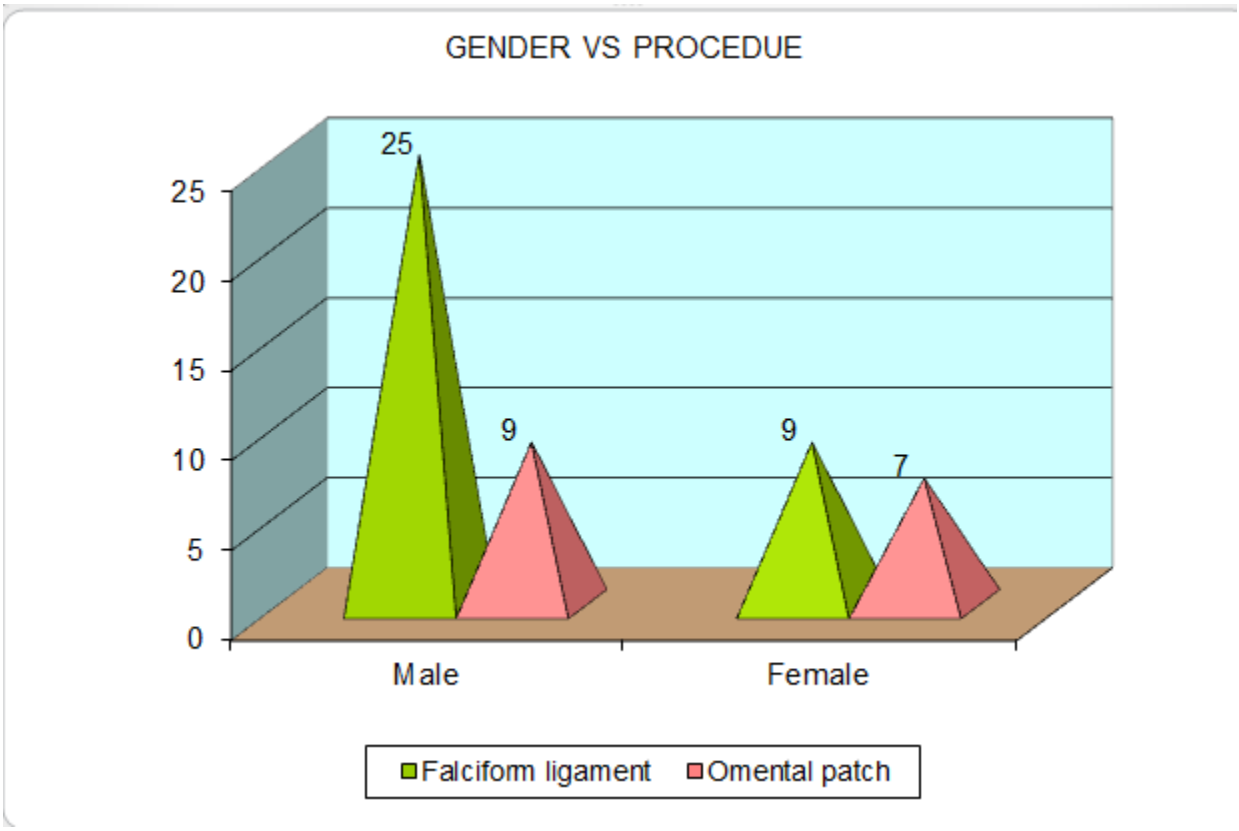
Postoperative leak was found only in 1 case out of 34 cases,p value is .003,found to be significant. postop mortality was not fond in any case of Figure of Eight repair, where 3 out of the 16 cases of omental repair had postoperative mortality. So in cases of patients presenting with perforation peritonitis in more than 6 hours Figure of Eight is superior to conventional omental patch in terms of mortality and postoperative leak.



In the present study, most of the atients presented after 6 hours so the omentum was found to be unhealthy so proceded with Figure of Eight

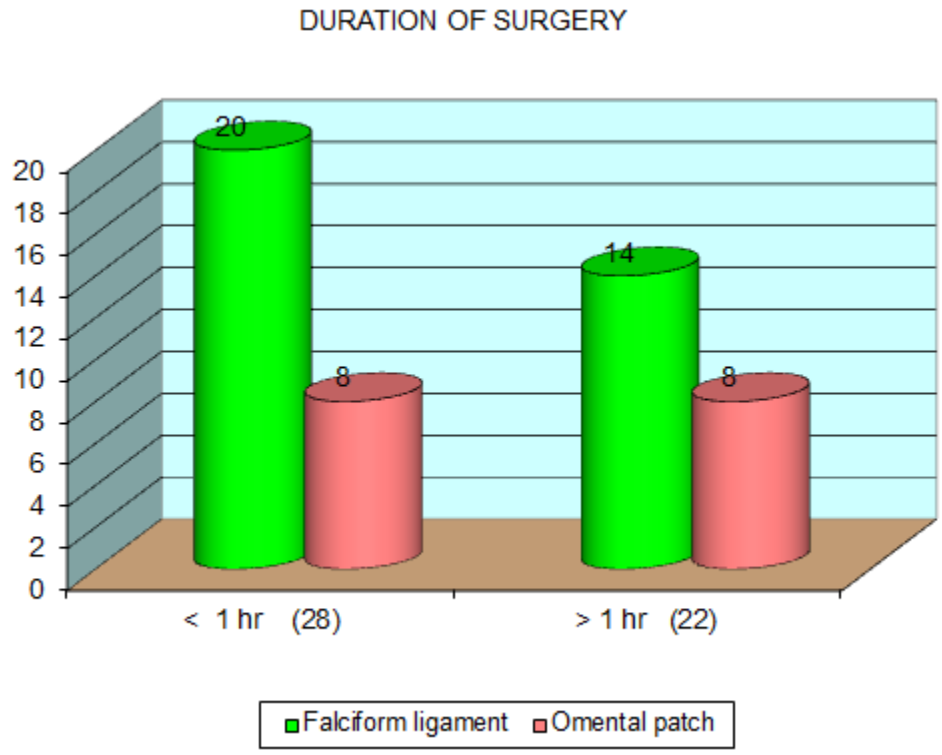


In the present study, most of the patients presented were over 50 years,ie almost 60% of the cases were of the age group more than 50 years

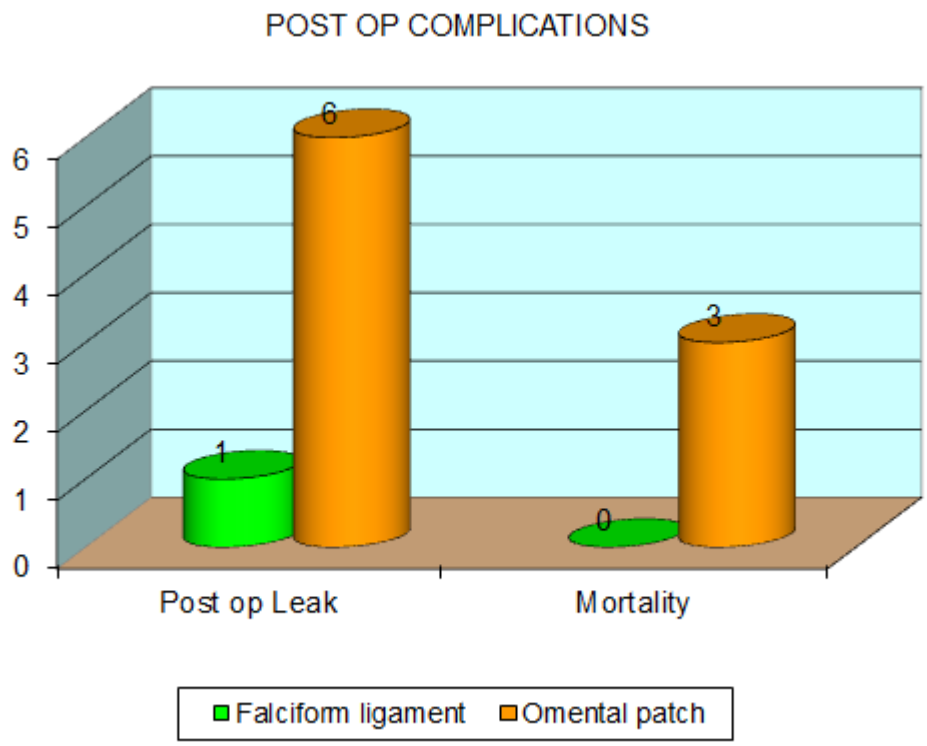


In the present study, out of the 50 patients ,34 were males and 16 were females,of the males 25 underwent Figure of Eight and 9 went for omental patch.

Of the females 9 underwent Figure of Eight repair and 6 went for omental patch repair.



Duration of surgery does not have any significance in both the groups as both are having comparable results, p value was fond to be 0.735



Post operative leak was found only in one case of Figure of eight,were 6 cases of omental patch developed leak, and the mortality was not found in cases which underwent Figure of eight repair,where one mortality was there in omental group,p value 0.003 regarding postoperative leak and 0.029 regarding mortality rates.

DISCUSSION

General outcome of a case of perforation peritonitis depends on many factors like age,time of presentation,size,site of perforation,availability of healthy omentum..

Obliteration of perforation using omental patches have shown more chances of postoperative leak and mortality rates, many studies have shown the efficacy of Figure of eight as a better alternative than omentum in cases where the patient's presentation is delayed and also there is no healthy omentum present. So the present study was undertaken to evaluate the efficacy of obliteration of perforation using Figure of eight as a better alternative than omentum in reducing incidence of postoperative leak.

In this study, 50 patients diagnosed as cases of perforation peritonitis, who underwent emergency surgery, were evaluated for time of presentation, duration of surgery, postoperative leak, mortality and postoperative hospital stay(group A – 34 Figure of eight patch, and group B – 16 omental patch).

There were no significant differences between the two groups with regard to age, duration of surgery and postoperative hospital stay.

In group A, 34 patients who underwent Figure of eight repair, had their perforation closed after taking sufficient bites through and through the perforation sing 2/0 vicryl

In group B,16 patients underwent omental patch repair had their perforation closed by taking through and through bites first and placing omentum over it using 2/0 vicryl.

In all the patients, 2 32F ICD drain were kept one in the pelvis and the other near the perforation site. .

The patients were followed for three weeks. Most of the patients went well without leak,and those who developed leak occurred in the first 5 days itself. In the present study we found that the Figure of eight technique significantly decreased the postoperative leak ($P < 0.003$; significant), and mortality(p value<0.029).

CONCLUSION

In the present study, 50 patients have completed the study protocol. Of this 34 patients in group A (Figure of eight) and 16 patients in group B (omental patch) .

After analyzing the data and observations,

The present prospective study demonstrated that the obliteration of gastroduodenal perforations using Figure of eight significantly reduces postoperative leak and mortality when compared with conventional omental patch.

Although the study sample is small in this present study, it is still wise to recommend Figure of eight for patients presenting very late or when healthy omentum is not available. .

SUMMARY

"Comparison of surgical techniques of gastroduodenal perforation closure, prospective study of Figure of eight versus omental patch"

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Conducted in department of general surgery at government rajaji hospital, Madurai from march 2017 to august 2017.

- Data collected in a prescribed proforma, analyzed and evaluated for duration of surgery,postoperative leak,postoperative hospital stay and mortality .
- Sample size was 50 patients in two groups, group A - 34 (Figure of eight) and group B – 16 (omental patch). All 50 patients completed study protocol.
- Of the 50 patients, 34 men with mean age 51(S D-14) years and 16 women with mean age 50 (S D -13) years.
- Patients were followed up for 3 weeks.
- There was no significance in both groups regarding operative time and postoperative hospital stay.
- Regarding postoperative leak only 1 case out of the Figure of eight and 6 cases in omental group developed leak, p value 0.003.
- Regarding postoperative mortality, no cases in Figure of eight group,3 cases in omental group had mortality,p value 0.029

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“COMPARISON OF SURGICAL TECHNIQUES FOR GASTRO DUODENAL PERFORATION CLOSURE: A PROSPECTIVE STUDY OF FIGURE OF EIGHT VERSUS GRAHAM OMENTAL PATCH”

PROFORMA

Name:	I. P. No:
Age/Sex:	Date of Admission:
Occupation:	Date of Operation:
Address:	Date of Discharge:

Clinical History
Physical Examination findings
Laboratory findings

Ultrasound findings

Xrays

Procedure performed

Intraoperative findings

<u>Postop period</u>

Started orals

Complications

Discharged Morbidity Mortality

SERIAL NO	NAME	AGE	GENDER	DURATION	LOCATION OF PERFORATION	DUARTION	LEAK	MORTALITY	PROCEDURE
1	paunraj	53	male	15	d1	45	no	no	Fig of eight
2	kuppan	61	male	18	d1	45	no	no	Fig of eight
3	rahman	49	male	22	d1	45	no	no	Fig of eight
4	kumaresan	40	male	25	d1	45	no	no	Fig of eight
5	alagu	74	female	27	d1	45	no	no	omental patch
6	perumalsamy	55	male	33	d1	45	no	no	Fig of eight
7	vanitha	55	female	15	gastric	45	no	no	omental patch
8	raja	44	male	16	gastric	45	no	no	omental patch
9	vasanthi	47	female	38	d1	50	no	no	omental patch
10	mathi	26	male	42	d1	52	no	no	omental patch
11	kathiresan	43	male	24	d1	55	no	no	Fig of eight
12	murali	56	male	24	d1	55	no	no	omental patch
13	solaimuthu	57	male	24	d1	55	no	no	Fig of eight
14	latha	49	female	28	d1	55	no	no	omental patch
15	chandran	44	male	32	d1	55	no	no	omental patch
16	selvam	43	male	33	d1	55	no	no	omental patch
17	gurusamy	53	male	36	d1	55	no	no	Fig of eight
18	pichai rawther	77	male	42	d1	55	yes	yes	Fig of eight
19	pandiduraid	43	male	24	d1	60	no	no	Fig of eight
20	suganya	43	female	30	d1	60	no	no	omental patch
21	syed sheik	52	male	36	d1	60	no	no	Fig of eight
22	kailairajan	54	male	36	d1	60	yes	no	Fig of eight
23	rani	59	female	43	d1	60	no	no	omental patch
24	john	61	male	44	d1	60	no	no	omental patch
25	mokkan	76	male	54	d1	60	yes	no	Fig of eight
26	senthil	47	male	72	d1	60	no	no	Fig of eight
27	srinivasan	46	male	60	gastric	60	no	no	Fig of eight
28	chitra	54	female	12	d1	65	no	no	omental patch
29	bala	45	male	24	d1	65	no	no	Fig of eight
30	radhakrishnan	38	male	14	d1	70	no	no	omental patch
31	gautham	25	male	48	d1	70	no	no	Fig of eight
32	shankar	48	male	56	d1	75	yes	no	omental patch
33	ajaz ahmed	51	male	33	d1	80	no	no	Fig of eight
34	danasekaran	44	male	24	gastric	80	no	no	Fig of eight
35	palsamy	72	male	53	gastric	80	no	no	omental patch
36	vairamuthu	42	male	12	gastric	85	no	no	omental patch

37	saravanan	60	male	30	gastric	85	no	no	Fig of eight
38	valli	65	female	9	d1	90	yes	no	omental patch
39	gopalakrishnan	47	male	25	gastric	90	no	no	Fig of eight
40	kanna	46	male	28	gastric	90	no	no	Fig of eight
41	pandidurai	55	male	28	gastric	90	no	no	omental patch
42	sasikumar	44	male	32	gastric	90	no	no	Fig of eight
43	karunanithi	83	male	6	gatsric	90	no	no	Fig of eight
44	harini	36	female	16	d1	110	no	no	omental patch
45	ganesan	57	male	48	d1	110	no	no	omental patch
46	ganga	53	female	24	gastric	110	no	no	omental patch
47	manickam	58	male	22	gastric	120	no	no	omental patch
48	manikandan	51	male	24	gastric	120	no	no	Fig of eight
49	shiva	36	male	44	gastric	120	no	no	omental patch
50	palani	39	male	28	d1	160	no	no	omental patch

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ETHICS COMMITTEE CERTIFICATE

Name of the Candidate	:	Dr.S.Satheess
Course	:	PG in MS., General Surgery
Period of Study	:	2015-2018
College	:	MADURAI MEDICAL COLLEGE
Research Topic	:	A prospective study on "A safer technique of closure of peptic ulcer perforation using figure of eight stitch
Ethical Committee as on	:	27.07.2017

The Ethics Committee, Madurai Medical College has decided to inform that your Research proposal is accepted.

Member Secretary

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